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Introduction

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Scientific and Technical Aerospace Reports (STAR) is a comprehensive abstracting and indexing journal covering worldwide report literature on the science and technology of space and aeronautics. It is published on the 8th and 23rd of each month.

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Scientific and technical reports of the National Aeronautics and Space Administration and its contractors; scientific and technical reports of government agencies, universities, and research organizations throughout the world.

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Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **1251**

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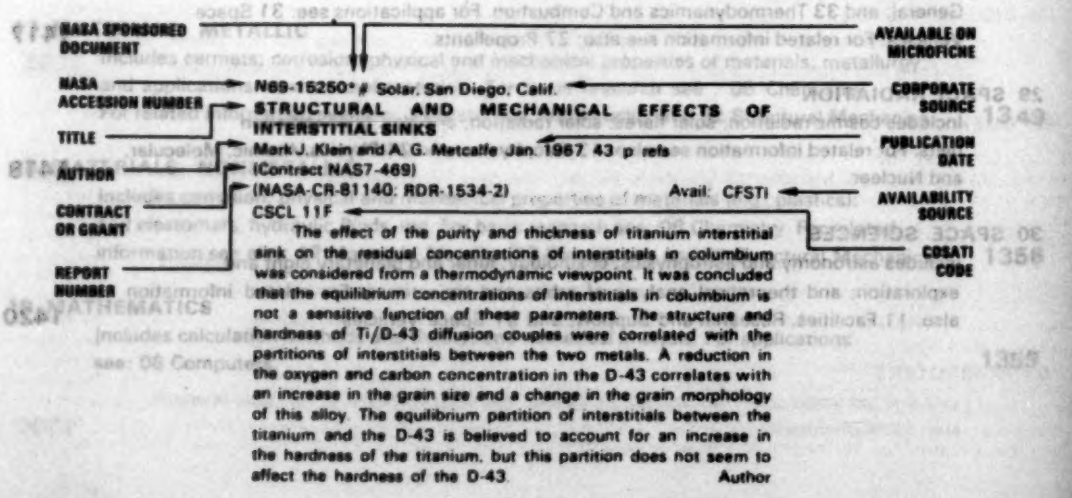
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The effect of the purity and thickness of titanium interstitial sink on the residual concentrations of interstitials in columbium was considered from a thermodynamic viewpoint. It was concluded that the equilibrium concentrations of interstitials in columbium is not a sensitive function of these parameters. The structure and hardness of Ti/D-43 diffusion couples were correlated with the partitions of interstitials between the two metals. A reduction in the oxygen and carbon concentration in the D-43 correlates with an increase in the grain size and a change in the grain morphology of this alloy. The equilibrium partition of interstitials between the titanium and the D-43 is believed to account for an increase in the hardness of the titanium, but this partition does not seem to affect the hardness of the D-43.
Author

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Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N69-18486# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THREE-DIMENSIONAL SUPERSONIC FLOW PAST A DELTA WING WITH BLUNTED EDGES

K. M. Magomedov et al *In its* Acad. of Sci. of the USSR. News. Fluid and Gas Mech. 28 March. 1968 p 1-8 refs (See N69-18485 08-12)

Avail: CFSTI

A hypersonic steady flow of an inviscid nonheat-conducting gas past a slab of triangular shape with a spherically blunted tip and cylindrically blunted leading edges at various angles of attack is investigated. Flow fields near such bodies were computed at M = 6, 7, 8 and ∞ in the angle of attack range from 0-15° and with sweep angle χ = 70° by the method of characteristics. A program written for a computer makes it possible to take equilibrium physicochemical transformations into account. Pressure distributions along leading edges and on the body surface in the planes of symmetry, shock parameters and shapes, enthalpy, and transverse velocity distributions are presented in graphs for various flow regimes. An analysis of the results shows that (1) a high entropy layer, with a sudden variation of enthalpy and density, is formed near a body with an increase in I; and that (2) in the region adjacent to surface γ = 0 a flow spreading from this surface in a near-shock layer and a flow convergence to the surface near the body were observed. Author

N69-18507# Aeronautical Research Council (Gt. Brit.) Turbomachinery Sub-Committee.

A WIND-TUNNEL INVESTIGATION OF THE STALLING PERFORMANCE OF TWO COMPRESSOR CASCADES OF DIFFERENT ASPECT RATIOS AT LOW SPEED

M. R. A. Shaalan (Liverpool Univ.) 28 Mar. 1968 38 p refs (ARC-30083; ULME-B-26) Avail: CFSTI

Two compressor cascades of aspect ratio 2.10 and 4.83 were tested up to the stall point in a working section with solid side walls. A change in aspect ratio was obtained by changing the blade chord only. The blade section profile was the 10C4/30C 50, staggered at 36 degrees with a space-chord ratio of 0.88, and there was no tip clearance. Reynolds number similarity was maintained but its value was kept above a 'critical' value. Substantial difference in performance is indicated between the two aspect ratios. The high aspect ratio cascade gives more deflection at the mid-span near stall, but stalls first. The long chord, low aspect ratio blade stalls gently whilst a classical type of sudden stall occurs at the other aspect ratio. Higher pressure rise coefficient is observed at the high aspect ratio, increasing slightly with incidence up to the stall point. Substantially higher spanwise contraction is evident with the low aspect ratio. The order of magnitude of the increase in axial velocity for both cascades is remarkably high. Further tests show that the wall stall, which is present at each incidence, is different in the two cases. It appears that the flow near the wall in the long chord blade rotates further in the passage and the stall near the end wall is more along the blade than along the wall. In the case of the short chord, the separation areas along the blade and the wall are approximately equal. The results for the overall performance are generally consistent with compressor work. Author (ESRO)

N69-18548# Aeronautical Research Council (Gt. Brit.)

FLOW NEAR THE APEX OF A PLANE DELTA WING

S. N. Brown (London Univ., Coll.) and K. Stewartson (London Univ. Coll.) 17 Jun. 1968 16 p refs (ARC-30323) Avail: CFSTI

A series expansion is obtained for the exponent n of the singularity of the solution of Laplace's equation for the flow near the apex of a plane delta wing when the angular sector occupied by the wing is small. A further term is found in the expansion due to Legendre when the wing is almost a half-plane, and the value of n appropriate to a quarter-plane is determined numerically. Author (ESRO)

N69-18596 National Lending Library for Science and Technology, Boston Spa (England).

INVESTIGATIONS OF FLOW AT TURBINE BLADES [STROEMUNGSUNTERSUCHUNGEN AN TURBINENSCHAUFELN]

Otto-Adalbert von Schwerdtner 21 Nov. 1968 19 p Transl. into ENGLISH from Siemens-Z (Erlangen), no. 41 Suppl., 1967 p 113-119 In ENGLISH and GERMAN (NLL-EE-Trans-1841-(3774.5)) Avail: Natl. Lending Library, Boston Spa, Engl.

Investigations of flow distribution in the blading and casings of steam turbines were made using recently developed complex test rigs. Methods of determining the effects of profile and cascade shapes by measuring the flow of air through straight cascades with parallel set blades are described. Stage test rigs are also discussed in which the radial pressure rise behind centrifugal cascades, and the centrifugal forces in the runner wheels which act on the flow, may be determined. These model configurations also enable measurement of the effects of the moving wall and of the interaction of the relative system of wheels on boundary and gap losses. A multistage rig is only necessary if the interaction of the stages must be determined. Another test configuration is described which utilizes closed circuit circulation; in cases where geometrical similarity between model and full scale design has been determined, this rig may be used to test for Mach and Reynolds number

agreement. Results obtained from tests utilizing the various configurations are compared and evaluated. A.C.R.

N69-18715# National Physical Lab., Teddington (England). Aerodynamics Div.

THE INTERACTION BETWEEN LOCAL EFFECTS AT THE SHOCK AND REAR SEPARATION. A SOURCE OF SIGNIFICANT SCALE EFFECTS IN WIND TUNNEL TESTS ON AEROFOILS AND WINGS

H. H. Pearcey, J. Osborne, and A. B. Haines (Aircraft Res. Assoc.) Sep. 1968 45 p refs Presented at the AGARD Specialist's Meeting on Transonic Aerodyn., Paris, 18–20 Sep. 1968

(NPL-AERO-NOTE-1071; ARC-30477) Avail: CFSTI

Attention is drawn to important restrictions to the range of applicability of the flow model developed in earlier work on shock-induced separation of turbulent boundary-layers on aerofoils and wings, and also corresponding restrictions to the conclusion then drawn that full-scale behavior could readily be reproduced at low Reynolds numbers. These restrictions arise because the model of a bubble growing progressively from the foot of the shock towards the trailing edge does not include the interaction that sometimes occurs between the disturbance at the foot of the shock and a subsonic-type rear separation if one exists, or is incipient, in the continuous adverse gradient further downstream. Such interactions are shown to be of increasing importance at wind-tunnel scale (as the possibilities of using thicker and more highly loaded wing sections develop) and to introduce real difficulties in reproducing full-scale behavior at low or moderate Reynolds numbers. Author (ESRO)

N69-18781# National Physical Lab., Teddington (England). Aerodynamics Div.

MEASUREMENTS OF THE OSCILLATORY PITCHING-MOMENT DERIVATIVES ON A DELTA WING WITH ROUND LEADING EDGES IN INCOMPRESSIBLE FLOW

L. Woodgate 2 Jul. 1968 26 p refs

(NPL-AERO-1276; ARC-30359) Avail: CFSTI

Oscillatory pitching-moment derivatives, m and $m_{\dot{}}$, have been measured on a round-leading-edged delta wing of aspect ratio 1.484 and of thickness to chord ratio 0.06. Mean incidence was varied from 0° to 15°, and frequency parameter and Reynolds number, based on the mean chord c, were varied from 0.2 to 0.1 and from 1.28×10^6 to 2.56×10^6 respectively. Comparisons are made with similar measurements on a sharp-edged delta wing of the same aspect ratio [1]. Differences between the results for the two models are found for both pitching axes used in the tests ($h = 1.0\,c$ and $h = 1.5\,c$). From the results for $h = 1.5\,c$ and from surface flow patterns, it appeared that for low angles of incidence ($\alpha < 5°$) the round leading edge suppressed the development of vortex flow sufficiently for it to have no effect on either derivative. Above $\alpha = 5°$, vortex flow was gradually established, giving a change in each derivative with incidence similar to that found on the sharp-edged model. Author (ESRO)

N69-19027*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

TUFT-GRID SURVEYS AT LOW SPEEDS FOR DELTA WINGS

John D. Bird Washington Feb. 1969 33 p refs

(NASA-TN-D-5045) Avail: CFSTI CSCL 20D

Tuft-grid surveys were made along the chord and in the near wake of 60°, 75°, 82.5°, and 86.5° delta wings at low speeds in the Langley stability tunnel to show the nature of the flow in the vicinity of such wing planforms. The results are presented without a detailed discussion in that the photographs of the flow patterns are felt to be largely self-explanatory. An unusual wake pattern which gave evidence of three asymmetrically arranged trailing vortices was obtained for the 86.5° delta wing at an angle of attack of 25° and zero sideslip. Author

N69-19028*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

USE OF SUPERPOSITION IN DIGITAL COMPUTERS TO OBTAIN WIND TUNNEL INTERFERENCE FACTORS FOR ARBITRARY CONFIGURATIONS, WITH PARTICULAR REFERENCE TO V/STOL MODELS

Harry H. Heyson Washington Feb. 1969 114 p refs

(NASA-TR-R-302) Avail: CFSTI CSCL 20D

A superposition method utilizing a digital computer is developed to obtain wall interference for arbitrary configurations. A variety of specific configurations are treated. Sample numerical results indicate that a large number of variables, such as wind-tunnel configuration, model configuration, wake deflection, model location, span of wing and tail, load distribution, sweep, angle tail height, may individually or collectively produce substantial effects on wall interference. Interference is particularly severe at the rear rotor of tandem systems; the maximum size of such systems for reasonable wall effects is discussed. Author

N69-19130*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PERFORMANCE CHARACTERISTICS FROM MACH 2.58 TO 1.98 OF AN AXISYMMETRIC MIXED-COMPRESSION INLET SYSTEM WITH 60-PERCENT INTERNAL CONTRACTION

Robert W. Cubbison, Edward T. Maleason, and David F. Johnson Washington Feb. 1969 64 p refs

(NASA-TM-X-1739) Avail: CFSTI CSCL 20D

A study has been made in the Lewis 10 by 10 foot supersonic wind tunnel to determine the performance characteristics of an axisymmetric, mixed compression inlet system designed for Mach 2.5. Inlet performance is presented for 0° and maximum unstart angle of attack. Diffuser static pressure distributions and compressor face total pressure profiles are shown for several operating conditions. Data presented show effects of Mach number, Reynolds number, bypass flow, and vortex generators on performance. Performance during restart cycles and required area ratios for restart are presented. Author

N69-19168# Aircraft Research Association, Ltd., Bedford (England).

FACTORS AFFECTING THE CHOICE OF A THREE-DIMENSIONAL SWEPT WING DESIGN FOR HIGH SUBSONIC SPEEDS

A. B. Haines Nov. 1968 19 p refs Presented at AGARD Specialists' Meeting on Transonic Aerodyn., Paris, 18–20 Sep. 1968 *Its* Paper No. 16

(Rept-9) Avail: CFSTI

The objectives for a three-dimensional sweptback wing design for operation at high subsonic speeds, and the alternatives are discussed. The main emphasis is on the factors that have to be borne in mind when choosing suitable target pressure distributions and isobar patterns. Results for two wings tested are used in illustration. For one of these wings, the isobar pattern is relatively uniform and the shock first appears aft to the crest; for the other, the flow pattern is more complex and in particular the shock forms ahead of the crest at a Mach number well below the design cruise condition. Author (ESRO)

N69-19243*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

FULL-SCALE INVESTIGATION OF THE AERODYNAMIC CHARACTERISTICS OF A SAILWING OF ASPECT RATIO 5.9

Marvin P. Fink. Washington Feb. 1969 32 p refs

(NASA-TN-D-5047) Avail: CFSTI CSCL 20D

An investigation was conducted to determine the aerodynamic characteristics of a full-scale model employing a sailwing having a wing aspect ratio of 5.9. The wing had a rigid leading-edge spar, rigid root and wing-tip ribs, a trailing-edge cable stretched between these ribs, and a fabric covering stretched between the leading and trailing edges. Included in the investigation were tests to determine the effect of a round leading edge as well as a D-spar leading edge on the aerodynamic characteristics of the model. Also, the effects of geometric dihedral on the lateral characteristics were determined. The aerodynamic characteristics of the sailwing compared favorably with those of a conventional wing in terms of maximum lift and maximum lift-drag ratio. The round-spar leading-edge configuration had higher lift coefficients but lower values of maximum lift-drag ratio than those of the D-spar configuration. Increased dihedral caused a decrease in maximum lift for both configurations, produced the expected increase in effective dihedral, and gave little effect on the directional stability characteristics. Author

N69-19298# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

CONTRIBUTION OF RHEO-ELECTRICAL ANALOGY TO THE CALCULATION OF THE AERODYNAMIC CHARACTERISTICS OF AIRCRAFT IN A STEADY OR UNSTEADY SUPERSONIC FLOW [CONTRIBUTION DE L'ANALOGIE ELECTRIQUE AU CALCUL DES CARACTERISTIQUES AERODYNAMIQUES D'UN AERONEF EN ECOULEMENT SUPERSONIQUE STATIONNAIRE OU INSTATIONNAIRE]

Michel Enselme [1967] 81 p refs In FRENCH; ENGLISH summary

(ONERA-P-119(1967)) Avail: CFSTI

The wing alone, including the lifting and symmetrical effects, is calculated; examples of application, preceded by a comparison of the results of the method to those obtained by analytical calculations, illustrate this method of calculation. Then this method is applied to the calculation of a wing–fuselage combination that numerical methods cannot solve, without making simplifying assumptions. The solving principle is also considered for other interaction problems (biplane and cruciform wings) for which the analogy is particularly well adapted. Finally, the principle of calculation of a wing in a cyclic, unsteady flow motion is presented. The application to wings of any planform is possible, but the precision of the method was verified only in the case of rectangular wings for which theoretical results are available. Author

N69-19301# Institut Franco-Allemand de Recherches, St. Louis (France).

MEASURE OF ROLLING TORQUE, NORMAL FORCE AND PITCH OF MOCK-UP OF AMETHYST ENGINE [MESURE DE COUPLE DE ROULIS, FORCE NORMALE ET MOMENT DE TANGAGE DE LA MAQUETTE DE L'ENGIN AMETHYSTE]

M. Fiechter and A. Schaub 23 Jun. 1967 27 p In FRENCH

(ISL-N-6/67) Avail: CFSTI

Measurements of aerodynamic forces and moments were made using a model of the Amethyst engine. Coefficients of normal force and pitching moments were measured as functions of angles of incidence from 0° to 90° with the orientation of the angle of roll 0° and 45°. Rolling torque was measured as a function of angles of roll from 0° to 360° with angles of incidence from 0° to 90°. Transl. by P.A.B.

N69-19541# Institut Franco-Allemand de Recherches, St. Louis (France).

CONTRIBUTION TO THE EXPERIMENTAL STUDY OF THE MAGNUS EFFECT. PART 1: DOCUMENTATION NOTE [CONTRIBUTION A L'ETUDE EXPERIMENTALE DE L'EFFET MAGNUS. PARTIE 1: NOTE DE DOCUMENTATION]

J. P. Renevier and M. Giraud 21 Mar. 1967 52 p refs In FRENCH

(ISL-D-2/67) Avail: CFSTI

The Magnus effect was studied as applied to a body of revolution stabilized by rotation or by symmetrical feathering. The Magnus force is a force which results from the combined effect of incidence and rotation on a projectile. The analysis of pressure, friction, and Magnus forces lead to developing aerodynamic coefficients which in turn are used in the equations of motion for a projectile. A mathematical analysis is performed on these forces. The nature of the boundary limit and the position of the transition have an important influence on the value of the Magnus force and on the position of the point of application of this force. For feathered projectiles, the Magnus effect depends upon three supplementary phenomena: pressure effect of the wing bases, deflection of the wings, and the interaction between the body and the feathers. Transl. by B.P.

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N69-18756# Royal Aircraft Establishment, Farnborough (England).

AN INTERIM NOTE ON THE DEVELOPMENT OF A BLIND GROUND ROLL SYSTEM IN A COMET 3B AIRCRAFT

M. L. Burgan May 1968 38 p refs

(RAE-TR-68119) Avail: CFSTI

Flight tests have been conducted to evaluate an experimental blind ground roll system suitable for completing a blind landing. The system tested was manually operated and consisted of an azimuth director fed by I.L.S. localiser, compass and yaw rate signals. Speed and distance information was also displayed to the pilot, the sensing device being a wheel speed pick-off. The tests showed that pilots were capable of producing good azimuth performance both following a normal automatic landing and also in the presence of some extremely unfavourable starting conditions. Using the ground roll director following an automatic landing, the standard deviation of lateral displacement reduced steadily from about 10 ft at 105 kt to about 5 ft when the aircraft stopped rolling. Developments of the system are being considered for both military and civil aircraft. Future work includes a study of the merits of automatic rudder control of the ground roll using a variety of pilots and equipment conditions. Author (ESRO)

N69-18766# Southampton Univ. (England). Inst. of Sound and Vibration Research.

THE MEASUREMENT OF SPINNING ACOUSTIC MODES GENERATED IN AN AXIAL FLOW FAN

B. D. Mugridge Aug. 1968 42 p refs Sponsored by Min. of Technol.

(ISVR-TR-8) Avail: CFSTI

Compressor noise which arises from aerodynamic interaction between stationary and rotating blades, becomes important during jet aircraft landing maneuvers. Consideration is given to propagation processes and the experimental techniques for determining the distribution of the total tone sound power of a given frequency among the various acoustic modes. The intensity and directivity of the radiation field is also estimated. The space-time correlation function between two probes was used to analyze the acoustic modes of an axial flow fan and it is possible that the duct intake bell mouth acted as an acoustic baffle giving rise to unpredictable lobes. Author (ESRO)

N69-19052*# Boeing Co., Seattle, Wash. Commercial Airplane Div.

DETAIL DESIGN AND INSTALLATION OF A DIRECT LIFT CONTROL FLAP FOR THE BOEING 367–80 AIRPLANE

Feb. 1969 50 p refs

(Contract NAS2-4200)

(NASA-CR-73292; D6-23595) Avail: CFSTI CSCL 01C

Detailed design specifications, installation, and flight tests of direct lift control auxiliary flaps and autothrottles on the Boeing 367–80 aircraft are presented. Included are a design description of the flap system, including its structure, actuation, electrical and hydraulic components, and results of safety and reliability analysis, as well as the details of the autothrottle servo drive and electronic circuitry. Systems checkout procedures included ground and flight tests to determine component reliability, and overall performance of the aircraft. A.C.R.

N69-19066# TRW Systems Group, Washington, D. C.

MOVING GROUND PLANE WIND-TUNNEL TESTS ON SEVERAL TRACKED AIR CUSHION VEHICLE (TACV) MODELS

1 Sep. 1968 100 p refs

(Contract C-353-66(Neg))

(TRW-06818-6029-R0-00) Avail: Issuing Activity

Tests were conducted on a 30-inch-diameter circular air cushion model and on an elongated model approximately 11 inches wide and 67 inches long. Each model's air cushion base area was 5 square feet. The models' air cushions were capable of operating in a peripheral-jet or hybrid-plenum mode. Circular model test results for both the forward-speed and hover state and the peripheral-jet and hybrid-plenum modes are reported. Results for the hover state and peripheral-jet mode are reported only for the elongated mode. In the hover state, the circular air cushion yielded a higher lift than the elongated one. For the cushion height of most interest, the circular modal lift was approximately 50 percent larger than the elongated one. The air cushion pressure parameter was influenced by jet Reynolds number, body shell proximity, and the quality of the ground surface. As demonstrated by the forward speed (wind tunnel) tests, the cushion aerodynamic characteristics differ for a moving ground plane and a fixed ground plane. With regard to lift, the hybrid-plenum air cushion's performance, with forward speed, was slightly better than that of the peripheral-jet cushion. However, the peripheral-jet cushion maintained its static lift well up to a free-stream dynamic pressure of twice the cushion gage pressure. Author

N69-19303 National Transportation Safety Board, Washington, D. C.

BRIEFS OF ACCIDENTS, US CIVIL AVIATION, ISSUE NO. 10; 1967 ACCIDENTS

[1968] 244 p *lts* Dockets 2-0951-1075; 3-4101-4700, and 1-0054-0066

Avail: CFSTI

Statistical and analytical tables in the form of printouts are presented containing detailed accident information for U.S. general aviation and air carriers. The cause factors, accident types, operational phases, location, kinds of flying, and injuries are listed. K.W.

N69-19304# Department of Transportation, Washington, D. C. National Transportation Safety Board.

ANNUAL REVIEW OF US GENERAL AVIATION ACCIDENTS OCCURRING IN CALENDAR YEAR 1967

Oct. 1968 144 p refs

Avail: Issuing Activity

Statistical information compiled from reports of 6115 general aviation accidents is presented. The information is first correlated and grouped according to cause/factor by kind of flying, collisions between aircraft, and selected accident data for all categories of aircraft. In subsequent tables the data are arranged as to injuries and accidents by kind of flying for (1) small fixed-wing aircraft, (2) large fixed-wing aircraft, (3) rotorcraft, and (4) glider aircraft. A yearly accident record for the period 1938–1967 is included. K.W.

N69-19462# World Meteorological Organization, Geneva (Switzerland).

METEOROLOGICAL PROBLEMS IN THE DESIGN AND OPERATION OF SUPERSONIC AIRCRAFT

R. F. Jones, R. M. McInturff, and S. Teweles 1967 84 p refs

(TN-89; WMO-No.216.TP.114) Avail: CFSTI

The design of commercial supersonic transport aircraft and the planned introduction of such aircraft into operational use in the early 1970s call for the study of a number of new meteorological problems. These problems are discussed in relation to the main phases of the flight of supersonic aircraft. A detailed description of sonic boom is given, and it is shown how its intensity observed at the ground is affected by various meteorological parameters such as pressure gradient, wind shear, temperature lapse rate, and turbulence. An account of the turbulence problem is presented. Turbulence associated with cumulonimbus activity, mountain waves, turbulence associated with jet streams, may all affect supersonic aircraft operations. The importance of the observation and forecasting of these phenomena is stressed and further lines of research on atmospheric turbulence are suggested. Among the hazards of supersonic flights to passengers and particularly crew are large doses of ozone and of cosmic radiation associated with solar flares. An effective system of cosmic radiation warnings may have to be established and filters employed to maintain the ozone concentration in the cabin at an acceptably low level. The damage that may be caused by the impact of hydrometeors and lithometeors on aircraft flying at high subsonic or supersonic speeds is treated in detail. The importance of both airborne and ground-based weather radar in locating heavy precipitation areas and cumulonimbus tops is emphasized. Author

N69-19467# National Center for Atmospheric Research, Boulder, Colo.

SUPERPRESSURE BALLOON FLIGHTS FROM CHRISTCHURCH, NEW ZEALAND, AUGUST 1967–JUNE 1968

Vincent E. Lally, Neil Carlson, Robert W. Frykman, Ernest W. Lichfield, A. Brewster et al. Feb. 1969 78 p

(NCAR-TN-38) Avail: Issuing Activity

Flight summaries, an analysis of flight results, and detailed data for each flight are presented for the Phase II GHOST balloon flights. During this period, 61 flights were made at altitudes between 1 km and 30 km. The balloons were variously instrumented to measure air temperature, strain on balloon material, sun angle, electronics temperature, wind shear, cosmic rays, gas temperature, and output of a cadmium sulfide solar cell panel. K.W.

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N69-18547# Royal Aircraft Establishment, Farnborough (England).
ON PREDICTING THE RELATION BETWEEN THE VOLTAGE AND CURRENT GENERATED BY A SPACECRAFT SOLAR CELL ARRAY
J. F. China May 1968 80 p refs
(RAE-TR-68138) Avail: CFSTI

This report presents a theory and some techniques which make it possible to predict the relation between the voltage and current generated by a spacecraft solar cell array in the space environment. Particular attention is given to the effect of shadows cast on the solar cell array by other parts of the spacecraft. Author (ESRO)

N69-18690# Royal Aircraft Establishment, Farnborough (England).
DEVELOPMENTS IN SOLAR CELL PERFORMANCE MEASUREMENT
F. C. Treble May 1968 33 p refs
(RAE-TR-68137) Avail: CFSTI

Basic procedures for measuring the orbital photoelectric performance of solar cells in experimental work and production acceptance testing are explained. An account is given of techniques and equipment which have been developed to achieve greater accuracy, with particular reference to the calibration of primary and secondary standard cells. Methods for checking the performance of solar panels during the assembly and test phases and for measuring their orbital performance before launch are described. Finally, an estimate of the accuracy of performance measurements in production is made, using the techniques and equipment which are now standard in U.K. Author (ESRO)

N69-18694# Kernforschungsanlage, Juelich (West Germany). Inst. fur Plasmaphysik.
SAFETY PROBLEMS IN THE JULIETTA CAPACITOR BANK
F. J. Friedrich and A. Liedtke Jun. 1968 18 p refs Sponsored in part by Brow Boveri Company and EURATOM
(Jul-540-PP) Avail: CFSTI

In 1967 the Julich capacitor bank was extended to an energy of 1, 2 MJoules and a crowbar system was installed. A survey of the bank characteristics and of the safety principles which were employed is presented. The probability of breakdowns in a system where currents of some 10 MA are flowing was decreased by dividing the bank and the collector, which is of the multi-plate type, into elements. The danger resulting from prefiring and misfiring of start-gaps has been eliminated by rapidly charging the master-trigger generator at the end of the charging cycle and by increasing the corresponding capacity. Electronic current monitoring systems have been installed for circuit protection. Author (ESRO)

N69-18793*# AiResearch Mfg. Co., Phoenix, Ariz. Space Power Systems Div.
DESIGN AND FABRICATION OF THE BRAYTON CYCLE HIGH PERFORMANCE TURBINE RESEARCH PACKAGE Final Report
James H. Dunn 14 Feb. 1968 65 p
(Contract NAS3-9427)
(NASA-CR-72478; APS-5281-R) Avail: CFSTI CSCL 10A

The research package consists of a 4.97-inch diameter turbine wheel and shaft mounted on ball bearings, and the associated mounting hardware. The preliminary design phase, during which optimum configuration and power levels were established, is summarized. Detailed data and descriptions are presented of the aerodynamic design approach, the final aerodynamic design, the turbine wheel thermal stress analysis, the critical speed analyses, bearing and seal design, and turbine instrumentation. Acceptance testing of the turbine research package consisted of a mechanical integrity spin-up test. K.W.

N69-18885*# Electro-Optical Systems, Inc., Pasadena, Calif.
HYDROGEN-OXYGEN ELECTROLYTIC REGENERATIVE FUEL CELLS
M. Klein and R. Astrin Washington NASA Feb. 1969 356 p
(Contract NAS3-2781)
(NASA-CR-1244) Avail: CFSTI CSCL 10A

A research and development program to develop an electrolytic regenerative hydrogen-oxygen fuel cell concentrated on the development of a capillary matrix bipolar pile fuel cell stack with integral gas storage tankage. Tasks were undertaken to select and develop electrodes and matrix materials for the regenerative fuel cell. A cell stack employing an oxygen electrode, a potassium titanate matrix, and a hydrogen electrode consisting of a platinized sintered porous nickel plaque was found to comprise the best cell construction. Such cells were cycled on a 35-minute discharge/65-minute charge test regime and attained life-times in the 500 to 1000 cycle range with minimal deterioration. A 500-watt 34-cell prototype, assembled at the end of the program, was subjected to a limited number of test cycles and yielded approximately 15 watt hours per pound. The program demonstrated the potential of the regenerative hydrogen-oxygen fuel cell concept and it is apparent that increases in cycle life and energy density can be achieved with additional development. Author

N69-19022*# General Motors Corp., Indianapolis, Ind. Allison Div.
PERIODIC REPORT, DESIGN OF A STRUT SUPPORTED TURBINE VANE WITH A WIRE-FORM POROUS SHELL
D. A. Nealy and R. D. Anderson 15 Jul. 1968 80 p refs
(Contract NAS3-7913)
(NASA-CR-72508; CDR-5923) Avail: CFSTI CSCL 10A

Details of the thermal and structural design analysis of a strut supported, porous wall turbine vane are presented. Calculations are made relative to the determination of required injection rate distributions, which in turn establish the internal compartmentation design and flow passage sizing. Calculated porous skin and strut cross section temperature distributions are presented for both design and off-design conditions. A simple structural analysis is performed to determine the stress levels in the strut and porous shell caused by gas and coolant pressure distributions around the airfoil. The calculated results show that the proposed design will exhibit satisfactory performance at the design condition. Author

N69-19031*# TRW Systems, Redondo Beach, Calif.
STUDY OF RADIATION EFFECTS IN LI-DOPED SILICON SOLAR CELLS Quarterly Report
R. G. Downing, J. R. Carter, and W. K. Van Atta 14 Feb. 1969 30 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952251)
(NASA-CR-100212; TRW-10971-6011-R0-00; QR-3) Avail: CFSTI CSCL 10B

Several groups of lithium doped float zone silicon solar cells were irradiated at two fluences and stored at room temperature. Half recovery times are observed for the corresponding fluences. The maximum annealed values are higher for the lower irradiation fluences but do not exhibit complete annealing in this fluence range. Previous experiments conducted on lithium doped crucible silicon solar cells indicate that, although annealing times are considerably longer, both the initial outputs and the maximum annealed outputs are higher than this group of float zone cells. Further, storage of lithium doped crucible cells at 80° to 100°C produce annealing times comparable to that of this group of lithium doped float zone cells. Lithium diffused silicon varying concentrations exhibit Hall coefficients in agreement with arsenic doped silicon and silicon doped with lithium in the melt. Carrier removal studies of this float zone lithium diffused silicon indicate an exponential dependence on lithium concentration of the carrier removal rate. Author

N69-19032*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A PARAMETRIC STUDY OF VARIATIONS IN WEIGHT AND PERFORMANCE CHARACTERISTICS OF LARGE-AREA SOLAR ARRAYS
R. E. Oliver, J. A. Garba, and J. H. Hix 1 Mar. 1969 99 p
(Contract NAS7-100)
(NASA-CR-100184; JPL-TR-32-1337) Avail: CFSTI CSCL 10B

A parametric study was made to establish relationships between performance characteristics (power-to-weight ratio, structural-member-section dimensions, structural resonant frequencies, deflections due to inertia loads, and structural-member stresses) and changes in design parameters for a large area solar array (LASA) design concept. Variations in design parameters considered include overall geometric scaling of subpanel planform, aspect ratio scaling of subpanel planform, scaling of applied inertial loading, changes in structural material properties, and changes in nonstructural weight. A computer program was developed to provide results of the parametric study in both tabular and graphical form. The graphical results are presented in a catalogue of plots which can be used to provide quick look evaluations of the characteristics to be expected for any new array design which incorporates the basic features of the existing LASA design concept. These plots also illustrate the possible disadvantages or advantages associated with alternative (other than beryllium) structural materials. Author

N69-19035# Hahn-Meitner-Institut fur Kernforschung, Berlin (West Germany).
INVESTIGATION OF THE CHANGE OF ELECTRICAL PROPERTIES OF THE SILICON SOLARCELL BPY 70 BY MEANS OF NEUTRONS, ELECTRONS, γ-, AND X-RAYS [UNTERSUCHUNG DER VERANDERUNG DER ELEKIRISCHEN EIGENSCHAFTEN DER SILIZIUM-SOLAR-ZELLE BPY 70 DURCH NEUTRONEN-, ELEKTRONEN- UND γ- STRAHUNG]
P. Dahlen and A. Spencker Aug. 1968 60 p refs In GERMAN
(HMI-B-73) Avail: CFSTI

Radiation damage of the n-p-Si-solarcell BPY 70 regarding ionization and displacement effects by nuclear reactor neutrons, 1.5 MeV-electrons, gamma-rays (^{60}Co), and X-ray radiation of 100 keV energy limit is reported. Measurements of short circuit current, open circuit voltage, maximum efficiency and spectral photosensitivity are accomplished. Diffusion length of minority carriers is evaluated from spectral photosensitivity by means of collection efficiency and the appropriate damage factor is given. Partial anneal of radiation damage is observed for high absorbed dose of neutrons ($>10^{15}n \cdot cm^{-2}$). Nuclear conversion of dopant boron into lithium, which is caused by the flux of thermal neutrons of the nuclear reactor may explain it. Author (NSA)

N69-19134*# TRW Systems Group, Redondo Beach, Calif.
STUDY AND ANALYSIS OF SATELLITE POWER SYSTEMS CONFIGURATIONS FOR MAXIMUM UTILIZATION OF POWER, PHASE 2. Technical Report, 12 Sep. 1966–31 Dec. 1968
31 Dec. 1968 129 p refs
(Contract NAS5-9178)
(NASA-CR-100189; TRW-04898-H001-R0-00) Avail: CFSTI CSCL 10

Work on two related tasks is reported. The first task is the computerization of EPSOM (Electric Power System Optimization Method), a technique for directly comparing two or more power systems, with system efficiency as the optimization criterion. Designed for evaluating solar-array battery power system configurations of earth-orbiting satellites, the technique was reduced to mathematical equations and implemented on the IBM 7094 computer. Power analyses were conducted by computer for three typical satellite missions. The second task consists of work on SRAP (Self-Regulating and Protecting), a technique providing a broad spectrum of failure mode and effects analyses, starting at the component level and progressing through the circuit and equipment levels to the power system. A minimum of three and a maximum of five parameters required for positive failure detection at the equipment level are identified. Detectors suitable for monitoring these parameters are studied, and remedial actions by SRAP are listed. An EPSOM user's manual and transfer function equations are included in this report. K.W.

N69-19207# Battelle-Northwest, Richland, Wash.
HYDRAULIC BALANCE CONCEPT AND TUBESHEET LEAKAGE FFTF HYDRAULIC FEATURE MODEL
P. M. Jackson Nov. 1968 78 p ref
(Contract AT(45-1)-1830)
(BNWL-883) Avail: CFSTI

Evaluations of the inlet plenum hydraulic balance concept and leakage rates resulting from various tube-to-tubesheet configurations are presented. Test apparatus and experimental results are presented. NSA

N69-19469 National Lending Library for Science and Technology, Boston Spa (England).
CALCULATIONS OF THE TEMPERATURE RISES FROM A HARMONIC ANALYSIS OF THE CURVE OF LOSSES. APPLICATION TO ELECTRICAL MACHINES [CALCUL DES ECHAUFFEMENTS A PARTIR D'UNE ANALYSE NON HARMONIQUE DE LA COURBE DES PERTES. APPLICATION AUX MACHINES ELECTRIQUES]
Max Marty 21 Nov. 1968 13 p Transl. into ENGLISH from Rev. Gen. Elec. (Paris), v. 75, Sep. 1966 p 1087–1090 In ENGLISH and FRENCH Presented at the 1st Sect. of the French Soc. of Electricians on Evolution of the Ideas on Tech. of Designing Large High Voltage Asynchronous Motors
(NLL-EE-Trans-1828-(3774.5)) Avail: Natl. Lending Library, Boston Spa, Engl.

The temperature rise of a part influenced by other parts and having additionally internal losses is calculated. It is pointed out that the time constants are directly related to the location and distribution of the internal losses as well as to the system as a whole. The rise in temperature is determined by a non-harmonic analysis of the loss curve, and the physical significance of the time constants is demonstrated. The method can be applied to electrical machinery, taking into account heterogeneity and anisotropy. Author

N69-19563*# Eagle-Picher Co., Joplin, Mo. Electronics Div.
HEAT-STERILIZABLE, REMOTELY ACTIVATED BATTERY DEVELOPMENT PROGRAM, PHASE 1 Quarterly Report, 1 Oct.–31 Dec. 1968
25 Jan. 1969 39 p Prepared for JPL
(Contract NAS7-100; JPL-952214)
(NASA-CR-100211; QPR-2) Avail: CFSTI CSCL 10C

This report delineates the progress during the second quarter of the development of a heat-sterilizable, sealed, remotely activated battery. The work effort is proceeding as an investigation of basic cell and battery components and materials to characterize the individual capabilities to withstand the heat sterilization routine and retain desirable properties. Testing of the silver oxide electrodes revealed that due to sterilization, a loss in capacity of approximately 30%–40% may be expected. In order to minimize the loss in capacity, the plate density and thickness must be optimized. Studies regarding the absorbent separators continued during the quarter. The cotton, asbestos, and Hemp separators were found to have the best absorption and wicking properties. The polypropylene materials failed during the sterilization cycle. Two (2) propellants have been tested which show promise as being capable of heat sterilization. The X30-50A-2 propellant is basically an ammonium perchlorate composition while the AN583 AF is an ammonium perchlorate with a polyester styrene binder. Author

N69-19571 National Lending Library for Science and Technology, Boston Spa (England).
DESIGN OF A FLUID/HYDRAULIC POSITIONAL DRIVE
B. A. Chelishchev Dec. 1968 12 p refs Transl. into ENGLISH from Mashinoved. (USSR) no. 1, 1966 p 59–68
(NLL-RTS-4711) Avail: Natl. Lending Library, Boston Spa, Engl.: 25s

A fluidic/hydraulic positional drive has been developed and tested, which is capable of displacing and stopping at any point in its travel with an attached mass up to 10,000 kg. Displacement speed can be controlled between 0 and 20 cm/sec. Control of the drive is remote and single-channel, and activated by feeding in a stabilized pressure signal of fixed magnitude. Author

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N69-18312# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
RADIOBIOLOGY, VOLUME 7, NUMBER 5
1967 284 p refs Transl. into ENGLISH from Radiobiologiya (Moscow), v. 7, no. 5, 1968 p 643–815
(AEC-tr-6954-Vol-7-No-5) Avail: CFSTI

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10. ON THE PECULIARITIES OF RADIATION SICKNESS IN THE CASE OF PARTIAL OR NONUNIFORM IRRADIATION OF THE ORGANISM AND THE POSSIBILITIES OF USING AUTOTRANSPLANTATION OF BONE MARROW UNDER THESE CONDITIONS G. S. Strelin p 174–198 refs (See N69-18322 08-04)

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12. THE PROBLEM OF THE NEURORADIOEMBRYOLOGICAL EFFECT I. A. Piontkovskii p 223–237 refs (See N69-18324 08-04)

13. ON THE CAUSES OF THE DISAGREEMENTS IN EVALUATING THE RADIOSENSITIVITY OF THE CENTRAL NERVOUS SYSTEM AMONG RESEARCHERS USING CONDITIONED REFLEX AND MAZE METHODS N. N. Livshits p 238–261 refs (See N69-18325 08-04)

14. RADIOECOLOGICAL INVESTIGATIONS IN SEAS AND OCEANS G. G. Polikarpov p 262–279 refs (See N69-18326 08-04)

N69-18313# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.
DEVELOPMENT OF RADIOBIOLOGY IN THE USSR DURING THE FIFTY YEARS OF SOVIET POWER
A. M. Kuzin *In its* Radiobiol., Vol. 7, No. 5 1967 p 1–22 refs (See N69-18312 08-04)
Avail: CFSTI

A history of the development of radiobiology in the USSR is presented. Stages in the advancement are: (1) mutagenic effects of cosmic rays, and the accumulation of radioactive substances in plants and animals; (2) use of X-rays and radium treatment in medicine; (3) establishment of isotope and radiation studies in the academy of Sciences; (4) genetic effects of radiation, and (5) radiation immunology. F.O.S.

N69-18314# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.
INFLUENCE OF IONIZING RADIATION ON THE MACROMOLECULAR ORGANIZATION OF DNA AND DNP
P. I. Tseitlin et al *In its* Radiobiol., Vol. 7, No. 5 1967 p 23–41 refs (See N69-18312 08-04)
Avail: CFSTI

The article surveys in detail the conclusions drawn from investigations of the effect of ionizing radiation on DNA and DNP in recent decades by various investigators, and presents the results of numerous experiments on various aspects: (1) comparison of the radiosensitivity of dry DNA and DNA irradiated in organs under conditions where the influence of metabolic processes and direct

influence on the radiosensitivity of the DNA were excluded: (2) study of dispersion of the optical rotation of DNA; (3) study of the variation in optical activity of DNA as a function of the percentage of protein; (4) comparison of the specific rotation of DNA, DNP and histone as a function of temperature, and (5) study of curves of the dispersion of optical rotation of DNP concentrations of salts leading to dissociation of the complex. Author

N69-18315# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

ON THE PRIMARY PHYSICOCHEMICAL MECHANISMS OF RADIATION INJURY

B. N. Tarusov *In its* Radiobiol., Vol. 7, No. 5 1967 p 42–55 refs (See N69-18312 08-04)

Avail: CFSTI

The mechanisms of oxidative reactions occurring in irradiated cells is studied. Lipids have been found to be the most radiochemically oxidizable cell substrate, and under the effect of radiation a nonstationary chain reaction develops which destroys the structural lipids. The EPR method has been used to study ultraweak luminosity in the blue-green region of the spectrum of all viable cells of animals and plants, resulting from ketone formation through recombination of peroxide radicals during oxidation of hydrocarbons and lipids. Author

N69-18316# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

ANALYSIS OF MODERN CONCEPTS OF THE PHYSICOCHEMICAL MECHANISMS OF THE PARTICIPATION OF OXYGEN IN RADIATION INJURY

L. Kh. Eidus *In its* Radiobiol., Vol. 7, No. 5 1967 p 56–73 refs (See N69-18312 08-04)

Avail: CFSTI

Based on a literature survey, it is concluded that the modifying influence of oxygen is connected with its action on radiation products with saturated valences, such as water or impurity radicals or ionized macromolecules with latent damage, one sign of which is long stability with unpaired electrons. The physical mechanisms by which the oxygen effect is accomplished are still not clear. Analogies of the effects of oxygen and nitric oxide indicate that the influence of oxygen is conditioned by the paramagnetism of molecules of gases which represent radicals in the fundamental unexcited state, which is correlated to the fact that they interact only with radical states of molecules. Author

N69-18317# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

BIOCHEMICAL MECHANISMS OF THE ACTION OF RADIOPROTECTORS

E. F. Romantsev *In its* Radiobiol., Vol. 7, No. 5 1967 p 74–88 refs (See N69-18312 08-04)

Avail: CFSTI

A survey of reported work on the biochemical mechanisms of radioprotector action is presented. Hypotheses about the mechanism are based on the fact of variation of cell radiosensitivity, possibly by hundreds of times, depending on the physical state of the cell, through biochemical mechanisms. Older animals are more radioresistant than young, and cold-blooded more radioresistant than warm-blooded. Cells in different phases of the life cycle vary in sensitivity, and therefore radio-sensitivity can be influenced by temporarily retarding the life cycles with certain chemical agents. Information obtained about the action of vitamins P, C, B_1, B_6 and B_{12}; of β-mercaptopropylamine, MEA, L-cystaine, AET and other protectors is presented and analyzed. Author

N69-18318# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

RADIATION DISRUPTIONS OF GENETIC INFORMATION IN THE CELL

M. I. Shal'Nov et al *In its* Radiobiol., Vol. 7, No. 5 1967 p 89–116 refs (See N69-18312 08-04)

Avail: CFSTI

Damages of nitrogenous bases of nucleic acids which change the meaning of genetic information have been studied on simple models with two types of radiolytic reactions, those accompanied by change in the ring structures (losses) and those taking place in the added group (modifications). The type of individual radiosensitivity of bases in quantum chemistry is explained by energy and structural characteristics of the molecular orbits which determine the ability of the bases to add free radicals. Schemes of the substitution of amino acids in polypeptides synthesized under the control of mutated genes are presented. The prevention of genetic damages has been studied by the prophylactic treatment of microbial cells with iodoacetamide before irradiation, which sensitizes them toward irradiation, and the prophylactic administration of amino acids to mice. Author

N69-18319# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

ON THE ROLE OF SULFHYDRYL GROUPS IN THE DETERMINATION OF NATURAL RADIOSENSITIVITY AND ITS ARTIFICIAL VARIATION

E. Ya. Graevskii *In its* Radiobiol., Vol. 7, No. 5 1967 p 117–137 refs (See N69-18312 08-04)

Avail: CFSTI

Radiosensitivity increases with complication of structure, but its main features can be considered a cellular problem, with DNA the principal target of the effect of ionizing radiation. Accumulated data indicate that the sulfhydryl groups can be a common basis of natural and artificial radiosensitivity, that their level in the cell can determine its radiosensitivity. This responsibility of the sulfhydryl groups has not been proven, and it has been suggested that their effect is not due to their participation in the act of protection, but to changes they cause in the biological object: possible increased activity of enzymes which shift the thiol-disulfide equilibrium in the direction of increase of SH-groups in the cell. Author

N69-18320# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

RECOVERY OF CELLS FROM INJURIES INDUCED BY IONIZING RADIATIONS: SOME COMPARATIVE ASPECTS

V. I. Korogodin *In its* Radiobiol., Vol. 7, No. 5 1967 p 138–161 refs (See N69-18312 08-04)

Avail: CFSTI

Comparisons of various manifestations of postirradiation recovery of cells, and a discussion of the mechanisms of viability recovery by irradiated cells are presented. Criticisms of the target theory and proposals for solving the problem of the role which the repair processes manifested in recovery of cells from radiation injuries are included. Author

N69-18321# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

THE PROBLEM OF POSTRADIATION RECOVERY IN THE LIGHT OF THE THEORY OF RADIOTOXINS

A. M. Kuzin *In its* Radiobiol., Vol. 7, No. 5 1967 p 162–173 refs (See N69-18312 08-04)

Avail: CFSTI

A survey of the literature dealing with the paths of formation of radiotoxins under the effect of distant γ or X irradiation, their

role in radiation damage of the cell, and the mechanisms of postirradiation recovery is presented. The path of recovery in which the postirradiation reduction of effect consists in halting the reactions leading to the accumulation of radiotoxins is emphasized. In studies of plant seeds it was found that a decisive stage in damage of cells is interaction of radiotoxins with the DNA of the nucleus and that damage can be reduced by washing the radiotoxins from injured tissues with two percent urea solution. The same method has been successfully used on frogs. In seeking new ways to reduce post-irradiation damage, methods directed toward reducing the level of radiotoxins in the irradiated organism cannot be disregarded. Author

N69-18322# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

ON THE PECULIARITIES OF RADIATION SICKNESS IN THE CASE OF PARTIAL OR NONUNIFORM IRRADIATION OF THE ORGANISM AND THE POSSIBILITIES OF USING AUTOTRANSPLANTATION OF BONE MARROW UNDER THESE CONDITIONS

G. S. Strelin *In its* Radiobiol., Vol. 7, No. 5 1967 p 174–198 refs (See N69-18312 08-04)
Avail: CFSTI

A survey of the literature is presented on experiments and observations of the importance of screening part of the bone marrow, and irregular irradiation in mice, rats and monkeys. Consideration is given to screening and transplantation in invertebrates, the effects of irradiation through grids, and the recovery of various tissues after radiation damage in connection with their regenerative activity. It has been found in experiments through grids and with autotransplantation of unirradiated parts of the bone marrow that the unirradiated tissues stimulate homopoiesis suppressed by irradiation. Author

N69-18323# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

TRANSPLANTATION OF CELLS TO IRRADIATED RECIPIENTS—A MODEL OF BIOLOGICAL INVESTIGATIONS

R. V. Petrov *In its* Radiobiol., Vol. 7, No. 5 1967 p 199–222 refs (See N69-18312 08-04)
Avail: CFSTI

A survey of the literature on the subject: use of irradiated animals as test tubes (cultivation in vivo). This consists of obtaining cells from a donor, transplanting them in a lethally irradiated recipient, and estimating the vital activity in the recipient. It permits studying the direct action of different types and doses of radiation, and radioprotectors. Radiation-induced inactivation of antibody formation has also been investigated. The purpose of the article was to attract the attention of investigators to a promising method which has developed. Author

N69-18324# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

THE PROBLEM OF THE NEURORADIOEMBRYOLOGICAL EFFECT

I. A. Piontkovskii *In its* Radiobiol., Vol. 7, No. 5 1967 p 223–237 refs (See N69-18312 08-04)
Avail: CFSTI

A survey of literature on the effect of irradiation of pregnant women for therapeutic or diagnostic purposes on the central nervous system of the embryo or fetus (neuroradioembryological effect (NREE)). Intrauterine manifestations of NREE have been studied inadequately from morphological aspects, considerably less from the genetic, biochemical and physiological. Postnatal manifestations of NREE can be quite varied and appear primarily as macroscopically visible congenital disorders of the brain structure, but often there are anomalies of brain development which are revealed only by detailed investigations of behavior, conditioned-reflex activity and electro-physiological indicators. Author

N69-18325# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

ON THE CAUSES OF THE DISAGREEMENTS IN EVALUATING THE RADIOSENSITIVITY OF THE CENTRAL NERVOUS SYSTEM AMONG RESEARCHERS USING CONDITIONED REFLEX AND MAZE METHODS

N. N. Livshits *In its* Radiobiol., Vol. 7, No. 5 1967 p 238–261 refs (See N69-18312 08-04)
Avail: CFSTI

A survey of the literature on the determination of radiosensitivity in rats by conditioned reflex and labyrinth methods is presented. The differences are explained by peculiarities of the methods and not by errors in the investigation. Disturbance of labyrinth activity is more readily compensated than that of conditioned reflex activity because, in a labyrinth, an animal can use information arriving simultaneously through various afferent systems and there are many afferent organs for response reaction. This is of great importance in radiation pathology, where focal disturbances of neuron functions are diffuse. Author

N69-18326# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

RADIOECOLOGICAL INVESTIGATIONS IN SEAS AND OCEANS

G. G. Polikarpov *In its* Radiobiol., Vol. 7, No. 5 1967 p 262-279 refs (See N69-18312 08-04)
Avail: CFSTI

A report is presented on recent activity in radioecological studies in seas and oceans as reflected in the proceedings of recent symposia and congresses. Author

N69-18331# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

RADIOBIOLOGY, VOLUME 8, NUMBER 1

1968 322 p refs Transl. into ENGLISH from Radiobiologiya (Moscow), v. 8, no. 1, 1968 p 1–308 (NEC-tr-6950-Vol-8-No-1) Avail: CFSTI

The articles presented pertain to radiation effects, tolerances, and damages in plants and animals, and the efficacy of antiradiation drugs. For individual titles, see N69-18332 through N69-18368.

N69-18332# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

THE RADIATION-CHEMICAL PROPERTIES OF DNA

V. A. Sharpatyi et al *In its* Radiobiol., Vol. 8, No. 1 1968 p 1–8 refs (See N69-18331 08-04)
Avail: CFSTI

The yields of radicals obtained in the irradiation of 0.2% frozen and liquid aqueous solutions of DNA and dry preparations were determined by the EPR method. It was found that the yields resulting from the indirect action of radiation (in liquid solutions) are larger by one order of magnitude than those from the direct action (in frozen solutions and dry samples). Author

N69-18333# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

RELATIVE RADIOSENSITIVITY OF THE SYNTHESIS OF NUCLEIC ACIDS (DNA AND RNA), GROWTH AND MULTIPLICATION OF YEAST CELLS

E. N. Sokurova et al *In its* Radiobiol., Vol. 8, No. 1 1968 p 9–24 refs (See N69-18331 08-04)

Avail: CFSTI

Saccharomyces vini yeast cells, strain Megri 139-B received a dose of 110 kr of Co-60 γ-irradiation (1–5% survival) and then were incubated for 30 hours. Samples were taken at various intervals and determinations were made of survival (microcolonies method), the number of cells, the percentage of gemmation, the quantity of biological mass, and the DNA and RNA contents. Without preventing first postradiation gemmation, the irradiation inhibited further multiplication of the culture much more than RNA synthesis and growth of the biological mass. DNA synthesis had an intermediate position in radiosensitivity. Author

N69-18334# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

THE EXCRETION OF THYMIDINE AND β-AMINOISOBUTYRIC ACID (BA, MA) IN RATS AS A FUNCTION OF THE DOSE OF THYMIDINE AND DNA, INTRODUCED INTO THE ORGANISM

V. K. Mazurik *In its* Radiobiol., Vol. 8, No. 1 1968 p 25–34 refs (See N69-18331 08-04)

Avail: CFSTI

Seventy male rats of the August line weighing 200 to 275 g were administered thymidine and equimolar quantities of DNA peritoneally in doses of 4, 5, 6, 7, and 8 micromoles/100 g of weight in physiological solution. Food and water were given without limitations. Samples of urine were taken and the thymidine and β-aminoisobutyric acid contents determined every six hours for a day before and after injection. Thymidine excretion increased in the first 12 hours after injection; that of β-aminoisobutyric acid was identical at all doses. About 90 to 95% of the thymidine, regardless of the dose, is used in oxidative splitting of thymidine and in DNA synthesis. Analysis indicated that disturbance of the reductive degradation of thymidine and of the final stages in DNA synthesis can play a substantial role in increasing thymidine excretion. Author

N69-18335# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

CHANGE IN THE CALCIUM CONTENT IN THE TISSUES OF RABBITS UNDER THE ACTION OF IONIZING RADIATION AND SUBSTANCES THAT INFLUENCE OXIDATIVE PHOSPHORYLATION

S. P. Grozdov *In its* Radiobiol., Vol. 8, No. 1 1968 p 35–46 refs (See N69-18331 08-04)

Avail: CFSTI

Calcium, potassium and sodium were investigated in the blood serum and tissue hydrolyzates of intact rabbits and rabbits subjected to the following effects: total γ-irradiation in a dose of 800 r by a cobalt source at a dose rate of 190 r/minute studied 24 hours and 8 days after irradiation); subcutaneous injection of Po-210 in a dose of 0.1 μcurie/kg (studied 16 days later); and intravenous administration of 6 ml of 0.4% solution of 2,4-dinitrophenol, 4 ml of 2.5% solution oleinate, and 1.2 ml of 0.25% solution of adenosine triphosphate (ADP) (studied after 15, 8, and 7 minutes, respectively). A considerable increase of calcium in the tissues followed the administration of Po-210, and increase also was caused by 2,4-dinitrophenol and sodium oleinate. Author

N69-18336# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

INFLUENCE OF NEPTUNIUM-237 ON THE ACTIVITY OF CERTAIN ENZYMES OF PHOSPHORUS METABOLISM

V. V. Kreslov *In its* Radiobiol., Vol. 8, No. 1 1968 p 47–53 refs (See N69-18331 08-04)

Avail: CFSTI

Female rats of the Wistar line with a starting weight of 160–170 g received one intravenous injection of Np-237 in nitric acid solution at a pH value of 2.0 in a dose of 1 μcurie (1.5 mg) per rat. The activity of alkaline and acid phosphatase and ATP-ase was investigated 1, 3, 7, 14, and 30 days later in the liver and kidney tissues. In the kidneys the activity of alkaline phosphatase was 50 percent of the control level a day later and about 20 percent after two weeks, when it rose, but it still was below the control levels after a month; the acid phosphatase activity decreased 30 percent in the first days and remained on that level for one month. In the liver the activity of both the alkaline and acid phosphatases decreased almost 50 percent in the first days, then gradually increased to the level of the controls. NP-237 did not affect the ATP-ase activity of the kidneys in a month; in the liver the activity tended to increase in the first two weeks but returned to normal after a month. Author

N69-18337# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

ON THE QUESTION OF PERMEABILITY AND THE BINDING OF S-35 CYSTEAMINE TO THE COMPONENTS OF THE LOACH SPERM CELL

I. D. Vinogradova et al *In its* Radiobiol., Vol. 8, No. 1 1968 p 54–62 (See N69-18331 08-04)

Avail: CFSTI

Sperms of *Misgurnus fossilis* were incubated with ^{35}S-tagged cysteamine and their activity was measured after they were washed five times with physiological solution. The cells could retain some of the introduced activity. Much of the activity is not strongly connected with the DNP of the cells and is readily liberated during water shock and first extraction of the nucleo-protein, but a small portion of a stronger complex of the protector with the DNP of the sperm cell exists which is not destroyed even during repeated treatment of the nucleoprotein. Author

N69-18338# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

STRONTIUM-90 METABOLISM IN GROWING RATS AS A FUNCTION OF THE AGE AND STATE OF THE CALCIUM METABOLISM

Z. V. Dubrovina et al *In its* Radiobiol., Vol. 8, No. 1 1968 p 63–73 refs (See N69-18331 08-04)

Avail: CFSTI

The offspring of female rats of the Wistar line which had received rations with identical ^{90}Sr activity ($\approx 2.5 \times 10^{-6}$ curies/animal/day) but with different calcium levels, when weaned, received the mother's ration but in a smaller quantity which was increased 10 percent every 10 days. Ca^{++} was added in the form of the chloride. Some animals received $^{90}SrCl_2$ with $CaCl_2$ and some animals, $^{90}SrCl_2$ with $^{45}CaCl_2$, administered once per os, through a probe or intraperitoneally a day before they were killed; numerous groups of 5 to 7 rats were killed during the experiment. Group I received 40 percent, group II 100 percent and group III 220 to 230 percent of the normal calcium level. The P content was identical in all groups and corresponded to the normal physiological requirement (Ca:P ratios of 1:1.5, 1:0.75 and 1:0.3, respectively). The results showed that the only acceptable method of calcium protection is strict observance of normal calcium feeding. Author

N69-18339# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

BEHAVIOUR OF THE BASIC COMPONENTS OF THE BONE MARROW OF RATS AND MICE DURING LOCAL IRRADIATION

E. N. Kabakov et al *In its* Radiobiol., Vol. 8, No. 1 1968 p 74–83 refs (See N69-18331 08-04)

Avail: CFSTI

The right rear extremities of male SVA mice 7 to 12 weeks old weighing 18 to 20 g and male Wistar rats weighing 180 to 200 g were irradiated at 214 r/min for 10 minutes. Five mice and five rats were killed each day for 10 days and their irradiated and shielded extremities examined. It was found that postradiation regeneration of the bone marrow occurs with a predominance of activity of the erythropoietic part. The regeneration may be called erythroid, with a high rate of accumulation of normoblasts (doubling in about 8 hours), a considerably higher than normal level of those cells in the marrow, a high maturation index in the erythroid population and inadequate mitotic activity. The hypothesis is expressed that a transformation of lymphocytes into erythroid cells occurs which becomes cyclic under the effect of radiation damage. Author

N69-18340# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

THE INFLUENCE OF IONIZING RADIATIONS UPON THE MECHANISMS OF THE DEVELOPMENT OF THE FEVER REACTION

N. A. Kalinina *In its* Radiobiol., Vol. 8, No. 1 1968 p 84–89 refs (See N69-18331 08-04)

Avail: CFSTI

Rabbits were irradiated with 1000 r at 17.6 r/minute and five days later were administered 0.3 ml of turpentine in the hip region. Before the experiment and every two hours for 24 hours after administration of the turpentine the leukocytes in the peripheral blood were counted and the temperature was measured rectally. Aseptic peritoneal exudate obtained 16 hours after intraperitoneal injection of apyrogenic physiological solution in donor rabbits was used as an endogenic pyrogen. In the irradiated rabbits, acute radiation sickness developed in a severe form, they lost weight, and sharply expressed leukopenia developed. Febrile reaction was much more weakly expressed than in unirradiated rabbits, not through suppression of ability to react to endogenic pyrogens but because of reduced formation of those pyrogens, evidently because of a sharp reduction in the number of leukocytes and a slower and weaker development of the inflammatory process. Author

N69-18341# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

CYTOCHEMICAL INVESTIGATION OF GLYCOGEN OF THE ELEMENTS OF THE THROMBOCYTIC SYSTEM: THE INFLUENCE OF IONIZING RADIATION OF THE ORGANISM

N. V. Traskunova *In its* Radiobiol., Vol. 8, No. 1 1968 p 90–94 refs (See N69-18331 08-04)

Avail: CFSTI

Forty-four rabbits of both sexes weighing 2.5 to 3.0 kg received a dose of 600 r of x-irradiation at 17 to 17.6 r/minute. The peripheral blood and specimens of bone marrow obtained by puncture were investigated one hour and 1, 3, 7, 12, 15, 20, and 30 days after irradiation. A sharp reduction in the glycogen level was observed. The impoverishment of the megakaryocytes in glycogen occurred in parallel with the development of thrombocytopenia in the peripheral blood. Application of stimulators of thrombocytopoiesis permitted preserving some predominance of glycogen-containing megakaryocytes in the experimental animals as compared with animals only irradiated. One way by which pharmacological and hormonal agents can influence thrombocytopoiesis of irradiated animals is by action on the intracellular metabolic processes of the megakaryocytes. Author

N69-18342# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

INFLUENCE OF CYSTAMINE ON POSTTRAUMATIC REGENERATION OF LOCALLY IRRADIATED SKELETAL MUSCULATURE

A. A. Klishov et al *In its* Radiobiol., Vol. 8, No. 1 1968 p 95–100 refs (See N69-18331 08-04)

Avail: CFSTI

The anterior tibial muscle was incised in 30 white rats weighing 150 g divided in four groups: (1) unirradiated; (2) after irradiation with a dose of 3 kr; (3) after administration of cystamine; and (4) after administration of cystamine, local irradiation for two hours and, after two more hours, injury of the irradiated muscle. The prophylactic administration of cystamine caused some improvement in the course of recovery of the skeletal muscle locally irradiated and, therefore, has some radioprotective effect, although slight, on the muscle tissue. Author

N69-18343# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

THE BEHAVIOUR OF PLUTONIUM (Pu 239) IN YOUNG PIGS

L. A. Buldakov *In its* Radiobiol., Vol. 8, No. 1 1968 p 101–106 refs (See N69-18331 08-04)

Avail: CFSTI

The distribution of 1% citric acid solution of Pu-239 (pH = 6.5) was investigated after administration of 3 μcuries intravenously to 15 young pigs 2.5 months old and weighing 10 to 12 kg and 33 curies perorally. Animals from the first group were killed in groups of three on 1, 9, 65, 330 and 640 days after injection and those of the second group on the day after administration. The absorption of plutonium citrate was 0.19% in the intestines and 87% of the resorbed portion of Pu was retained in the skeleton. The maximum content in the spongy bones was only three times (after intravenous injection, 3 to 10 times) as much as in the compact parts of the skeleton. The Pu concentration in the bones was 3 to 10 times as large as in the soft tissues (excluding muscles) after peroral and 20 to 100 times as large after intravenous administration. Author

N69-18344# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

DISTRIBUTION AND BIOLOGICAL EFFECTS OF AMERICIUM-241

G. A. Zalikin et al *In its* Radiobiol., Vol. 8, No. 1 1968 p 107–118 refs (See N69-18331 08-04)

Avail: CFSTI

Americium-241 was administered in the form of the chloride intravenously and intratracheally (0.5 and 0.3 ml, respectively, 2 μcuries/liter) and perorally (1.0 ml, 2 and 19 μcuries/liter) to white rats weighing an average of 200 g. At certain intervals the rats were killed and samples taken from the organs and tissues for determination of γ-radiation as percent of the introduced activity. After intravenous administration, AM-241 rapidly accumulates in the liver (about 57%) and skeleton (about 18%) and high accumulations are noted in the kidneys (1.1%), liver (7.1%), bones (1.41%), spleen (0.65%), thyroid gland (0.43%), adrenal glands (0.18%), and ovaries (0.03%). After intratracheal administration it was slowly absorbed from the lungs; the effective period of

half-excretion of the excreted portion is 66 days. In peroral administration not more than 0.03% is absorbed from the gastrointestinal tract. Author

N69-18345# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.
NUMBER OF IMMUNOCOMPETENT AND COLONY FORMING CELLS IN THE MOUSE SPLEEN AT VARIOUS PERIODS AFTER IRRADIATION
V. A. Kozlov et al *In its* Radiobiol., Vol. 8, No. 1 1968 p 119–130 refs (See N69-18331 08-04)
Avail: CFSTI

Mice of inbred CBA line were irradiated with cobalt γ-rays in a dose of 600 r and investigated 1, 7, 30, and 60 days later. Maximum suppression of antibody formation was observed after 1 and 7 days; it was partially restored after 30 days, but even after 60 days the number of immunocompetent cells in the spleen was only 59 and 46 percent of the controls. The quantity of colony forming units was sharply reduced after 1 and 7 days; after 30 days it was 103 percent in terms of 1×10^7 cells of the spleen and 63 percent in terms of the entire organism. Author

N69-18346# Atomic Energy Commission, Washington, D.C. Div of Technical Information.
TIME INTERVAL BETWEEN IRRADIATION AND MITOSIS IN A CULTURE OF HUMAN LEUKOCYTES AND NUMBER OF CHROMOSOME ABERRATIONS
V. M. Kozlov *In its* Radiobiol., Vol. 8, No. 131–134 refs (See N69-18331 08-04)
Avail: CFSTI

Irradiation of human leukocytes in the presynthetic state in vitro with ^{60}Co γ-rays in a dose of 100 r caused chromosome aberrations in 20 percent of the cells, most of them paired fragments and dicentrics with a single pair of fragments. Increase of the interval between irradiation and mitosis by days in human leukocytes in vitro does not change the cytogenetic effect of irradiation. Author

N69-18347# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.
INFLUENCE OF CYSTAMINE AND MAGNESIUM IONS ON THE INDUCTION OF TEMPERATE PHAGE λ INDUCED BY X-RAYS
M. A. Guberniev et al *In its* Radiobiol., Vol. 8, No. 1 1968 p 135–145 refs (See N69-18331 08-04)
Avail: CFSTI

A four hour bouillon culture of lysogenic cells of *E. coli* K-12 (λ) and one day indicator strain *E. coli* C-85 were x-irradiated with a dose of 4000 r at 67.5 r/sec. The modifying effect of magnesium ions on phage induction caused by ionizing radiation was studied and it was shown that MG is necessary not only for intracellular development of the bacteriophage but also for its induction by the action of ionizing radiation on lysogenic bacteria. The complete removal by MG ions of the anti-induction effect of cystamine on lysogenic bacteria was reproduced. It is proposed that one of the possible mechanisms of the radioprotective action of cystamine is the binding by the protector of magnesium ions in the bacterial cell. Author

N69-18348# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.
THE INFLUENCE OF γ-RAYS ON THE FORMATION OF ANEUPLOIDY DURING MITOSIS
M. M. Antoshchina *In its* Radiobiol., No. 8, No. 1 1968 p 146–150 refs (See N69-18331 08-04)
Avail: CFSTI

Plasma obtained from the blood of a woman 25 to 35 years old was irradiated with ^{60}Co γ-rays in a dose of 100 r and cultivated, and the cells were fixed after 60, 72, 85, 95, 110 and 120 hours. After irradiation the frequency of hypoploid cells increases in the second mitosis (fixation after 85 to 85 hours) and is reduced to the spontaneous level in the third (110 to 120 hours). The frequency of hyperploid cells is far smaller and its variation in time is statistically unreliable. Author

N69-18349# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.
INFLUENCE OF CYSTAMINE ON BLOOD VESSEL TONUS BEFORE AND AFTER IRRADIATION
J. I. Bachurina *In its* Radiobiol., Vol. 8, No. 1 1968 p 151–158 refs (See N69-18331 08-04)
Avail: CFSTI

Isolated rabbit ears from four groups (intact animals, animals administered cystamine, irradiated animals, and irradiated animals who had received cystamine) (irradiation—a dose of 800 r at 24.8 r/minute) were tested by the perfusion method with p = 70 cm col. H_2O and t = 37 to 39°C. There were no substantial differences in perfusion between intact animals and irradiated animals which had received cystamine. Weakening of the vasoconstrictive reactions of rabbit ear, usually observed in the period of primary reaction to irradiation, can be connected with the spasmolytic and adrenolytic action of cystamine. Author

N69-18350# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.
INFLUENCE OF PROTECTORS ON THE IRREVERSIBLE COMPONENT OF RADIATION INJURY
J. P. Yarmonenko et al *In its* Radiobiol., Vol. 8, No. 1 1968 p 157–166 refs (See N69-18331 08-04)
Avail: CFSTI

AET, mexamine, MEA and cystaphos were administered to white mice and rats (150, 75, 150 and 350 mg/kg to mice and 100, 15, 100 and 350 mg/kg to rats) intraperitoneally 10 minutes before irradiation with a single dose of x-rays (180 kV), Co-60 γ-rays or 680 MeV of protons. Examinations were made in the first mitosis: in the bone marrow 12–24 hours after irradiation and in the liver 30 hours after partial hepatectomy carried out one day after irradiation. The radiosensitivity of liver and bone marrow cells differed little on the basis of chromosome aberrations; each had 15 to 20 percent aberrant cells per 100 r. Mexamine was almost identically effective in protecting both types of cells, whereas the thiol protectors were ineffective with respect to liver cells. The possible role of radiation injuries of the chromosomes in the formation of the irreversible component of damage to the organism was examined. In actively proliferating tissues it is manifested in both acute and remote effects of irradiation, but in tissues with low physiological regeneration mainly causes remote aftereffects. Author

N69-18351# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.
REDISTRIBUTION IN THE SYNTHESIS OF NEWLY FORMED RNA FRACTIONS AFTER IRRADIATION
V. I. Tokarskaya et al *In its* Radiobiol., Vol. 8, No. 1 1968 p 167–177 refs (See N69-18331 08-04)
Avail: CFSTI

Unsprouted germs of the seed of the radiosensitive pea variety Pobeditel, both dry and after being soaked in water for four

hours, recieved a dose of 20 kr at 700 r/min (^{133}Cs). In the first series of experiments the seeds were again moistened after irradiation and the germs were removed and again exposed for 20 minutes, 4 hours and 16 hours in inorganic phosphate ^{32}p solution. In the second series, 7-day sprouts were exposed in a sealed chamber in a ^{14}CO atmosphere; the high-polymer RNA was separated by means of sodium dodecylsulfate at pH ≈ 5.0 and then treated with DNA-ase. The DNA-ase was then separated and the RNA analyzed chromatographically; the composition of the RNA fractions tagged with ^{32}P was determined after alkaline hydrolysis and electrophoresis on the basis of the radioactivity of the 2', 3'-mononucleotides. A redistribution of the synthesis of the RNA fractions was found. After irradiation the synthesis of RNA with an AU type of nucleotide composition decreases and the rate of synthesis of ribosomal RNA increases. Author

N69-18352# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

THE FORMATION OF FORMYL DERIVATIVES OF FOLIC ACID IN THE HYALOPLASM OF THE PIGEON LIVER AFTER IRRADIATION AND ADMINISTRATION OF A PROTECTOR

E. F. Romantsev et al *In its* Radiobiol., Vol. 8, No. 1 1968 p 178–183 refs (See N69-18331 08-04)

Avail: CFSTI

Pigeons were irradiated with the absolutely minimum lethal dose of γ-rays, 3000 r in 19 minutes 2 seconds. The formation of formyl derivatives of folic acid in liver extract was inhibited in 10 to 60 minutes and was normalized in 24 hours. The injection of β-mercaptopropylamine (200 mg/kg), a dose with a strongly expressed radioprotective action, caused a sharp suppression of the synthesis of the formyl derivatives of folic acid 10 minutes after injection. Author

N69-18353# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

THE INFLUENCE OF PERIODS OF STORAGE OF IRRADIATED SEEDS AND FRACTIONATION OF THE γ-RADIATION DOSE ON THE RADIOSENSITIVITY OF THE COTTON PLANT AND CHANGE IN THE RADIOSENSITIVITY DURING ONTOGENESIS

N. N. Nazirov et al *In its* Radiobiol., Vol. 8, No. 1 1968 p 184–196 refs (See N69-18331 08-04)

Avail: CFSTI

Dry seeds of early ripening radioresistant variety 1306-DV and late ripening radiosensitive variety S-1622(16) of *Gossypium hirsutum* were irradiated with 5, 10, 15, and 20 kr doses of Co-6 γ-rays at 23 r/sec and stored 1, 27, 63 and 127 days for both varieties and 3 years for S-1622 under room conditions, then soaked in water and sown. During storage for 3 years of seeds irradiated with relatively massive doses, the biological effect of irradiation was intensified. Radiostimulation was expressed more strongly in the late ripening than in the early ripening variety. A single massive irradiation was more harmful than fractionated irradiation at the same dose. The processes of formation of morphological signs were more sensitive to irradiation than growth processes. The radiosensitivity of cotton varies noticeably during ontogenesis. High sensitivity appears in the first period of development and reaches a minimum toward the start of blossoming, which coincides with the moment of natural growth in height. Author

N69-18354# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

EFFECT OF γ-IRRADIATION OF SEEDS ON THE SURVIVAL, GROWTH, DEVELOPMENT, AND FRUIT-BEARING OF ARABIDOPSIS THALIANA (L.) HEYNH

V. I. Ivanov et al *In its* Radiobiol., Vol. 8, No. 1 1968 p 197–207 refs (See N69-18331 08-04)

Avail: CFSTI

Arabidopsis thaliana (L.) Heynh. shoots 2 to 4 months old were irradiated with Co-60 γ-rays in doses of 10, 20, 40, 70, 110, 160, 220, and 290 kr at a rate of ≈ 3.7 kr/minute. They were placed at once on the surface of an agarized mineral nutrient medium and raised in a light chamber with a cycle of 20 hours of light at ≈ 25°C and 4 hours of darkness at 19°C. Phenological observations were made daily for 8 weeks. The number of stalks was counted during the generative phase. The plant was found to be highly radioresistant, with LD_{50} of ≈ 100 kr. Germination was effected least, without decrease at up to 300 kr. Most deaths occurred in the phases of cotyladenous leaves and rosettes but most plants surviving those phases at up to ≈ 160 kr reached fruit bearing. The growth of root and stalk was halved at ≈ 20 kr, the rate of vegetative development at ≈ 70–100 kr, and the rate of generative development at ≈ 40 to 70 kr. With increase of the dose the percentage of fruitful plants decreases (D_{50} = ≈ 160 kr), as does the average number of seeds of fruitful plants. Author

N69-18355# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

GROWTH AND SURVIVAL OF THE FERN (PTERIS LONGIFOLIA L.) AS A FUNCTION OF THE DOSE OF X-RADIATION AND TIME OF SOWING OF SPORES AFTER IRRADIATION et al *In its* Radiobiol., Vol. 8, No. 1 1968 p 208–217 refs (See N69-18331 08-04)

Avail: CFSTI

Dry spores of the fern *Pteris longifolia* L. received x-irradiation of 30, 60, 120, 240, and 350 krad at 17.2 krad/minute and 5, 10, 20, 50, 100, 190, 280, and 370 krad at 4.7 krad/minute and then were sown after various intervals of time. The material was examined after 10, 20, and 30 days. It was found that the germination of spores and growth of gametophytes depend on the absorbed dose and the time between irradiation and sowing. At doses of 350 to 370 krad (sowing at one once), 240 to 280 krad (sowing after a month), and 120 to 190 krad (sowing after a year), no spores germinate at all. The germination of spores and growth of gametophytes decreases with increase of the time between irradiation and sowing. LD_{50} was 50 krad (sowing at once), 35 krad (sowing after a month), and 25 krad (sowing after a year). Author

N69-18356# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

DOSIMETRIC CHARACTERISTICS OF X-RADIATION AND MEASUREMENT OF ABSORBED DOSES IN THE IRRADIATION OF SMALL BIOLOGICAL SPECIMENS

Yu. B. Nikulin et al *In its* Radiobiol., Vol. 8, No. 1 1968 p 218–224 refs (See N69-18331 08-04)

Avail: CFSTI

The measurement is determined of the quality of radiation generated under specific conditions of radiation and of the absorbed doses obtained in that case by water equivalent biological objects with a volume of not more than 2 to 3 ml, irradiated near the focus of the tube to obtain as large a dose rate as possible. It was found that to describe the x-irradiation with a maximum voltage on the tube of 50 to 200 kW it is necessary to note the following characteristics: the maximum voltage on the tube, the effective radiation energy, the layer of half-attenuation, the coefficient of uniformity and the absorbed dose rate. The effective energy can remain constant with the use of near focus apparatus while the

dose rate varies by ±25 percent because of various factors not readily taken into account. Therefore, the dosimetry should be carried out immediately before irradiation. Author

N69-18357# Atomic Energy Commission, Washington, D. C. Div of Technical Information.

POSSIBILITIES OF USING SEMICONDUCTOR DETECTORS OF IONIZING RADIATION IN RADIOBIOLOGY AND MEDICINE

A. A. Petushkov *In its* Radiobiol., Vol. 8, No. 1 1968 p 225–236 refs (See N69-18331 08-04)

Avail: CFSTI

A literature survey is presented on applications of semiconductor detectors of ionizing radiation in radiobiology and medicine. The most suitable are those based on silicon and germanium with p-n and p-i-n junctions (small dimensions, high energy resolution, low power consumption, etc.), but they have low radiation resistance and require special electronic equipment to record signals. They are promising in radiometric and spectrometric analyses in investigations of the distribution, separation, and content of radioactive substances in the living organism. Surface barrier AuSi detectors are used in work with α-radioactive isotopes, and diffusion drift Si(Li) detectors in work with β- and α-emitters. Author

N69-18358# Atomic Energy Commission, Washington, D. C. Div. of Technical Information

RANGES OF PROTONS IN BIOLOGICAL TISSUE

G. G. Drozd *In its* Radiobiol., Vol. 8, No. 1 1968 p 237–244 refs (See N69-18331 08-04)

Avail: CFSTI

Calculations are presented on the path of protons in biological tissue in the energy range of 500 eV to 10 MeV. A formula is used for the region 500 eV to 1.0 keV, a formula is derived for the region 10 to 900 keV, and literature data are used for the region 900 keV to 10 MeV, with good fit of the curve segments. Author

N69-18359# Atomic Energy Commission, Washington, D. C. Div of Technical Information

ON THE DIVISION OF THE NEUTRON SPECTRUM INTO GROUPS

G. G. Drozd *In its* Radiobiol., Vol. 8, No. 1 1968 p 245–253 refs (See N69-18331 08-04)

Avail: CFSTI

Energy ranges are reviewed used to devide the neutron spectrum into groups and a division of the spectrum of neutrons acting on biological tissue is proposed which takes into consideration two main processes: interactions of neutrons with the nuclei of atoms of the tissue and interactions of secondary particles, forming during the action of neutrons on the tissue, with elements of the tissue. The proposed energy ranges are: 0 to 1.0 eV for thermal; 1.0 eV to 5 keV for slow (epithermal); 5 keV to 1 MeV for intermediate; 1 to 50 MeV for fast; and above 50 MeV for ultrafast neutrons. Author

N69-18360# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

THE ROLE OF THE OXYGEN EFFECT IN THE RADIOPROTECTING ACTION OF PROPYLAMINE AND ITS DERIVATIVES

M. M. Konstantinova et al *In its* Radiobiol., Vol. 8, No. 1 1968 p 254–257 refs (See N69-18331 08-04)

Avail: CFSTI

White mice of both sexes weighing 18 to 20 g were irradiated with 900 r of Co–60 γ-rays at 217 r/minute. The following were administered in 0.3 ml of distilled water 15, 30, 60, 90, and 120 minutes before irradiation or measurement of the oxygen content in the tissues: 6 mg of propylamine (PA), 16.5 mg of β-mercaptopropylamine (MPA), 2.75 mg of dimercaptopropylamine (DMPA), 3.6 g of γ-bromopropylaine (MBPA), and 4.5 mg of dibromopropylamine (DBPA). PA had no protective effect and did not influence the oxygen content in the spleen. MPA gave 60 to 80 percent survival depending on the time between administration and irradiation. DMPA greatly increased the radioresistance of mice irradiated 30 minutes after its administration. With MBPA and DBPA the protective activity increased in proportion to the time between administration and irradiation (a maximum at 90 minutes). Author

N69-18361# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

THE FREQUENCY OF ABERRANT CELLS AND THE AMOUNT OF BLOCKING OF THE CELL CYCLE AS A FUNCTION OF UV IRRADIATION

A. G. Antoshechkin et al *In its* Radiobiol., Vol. 8, No. 1 1968 p 258–262 refs (See N69-18331 08-04)

Avail: CFSTI

Fibroblast-like aneuploid cells of the Chinese hamster were treated with ^{3}H-thymidine, UV-irradiated with 260 mμ in doses of 15, 30, and 60 ergs/mm^2, and fixed after definite times of incubation. The time after which 45 percent tagged metaphases occurred was recorded: 15 hours for unirradiated cells and 18, 21, and 28 hours for those receiving 15, 30, and 60 ergs/mm^2, respectively. A dose of 120 ergs/mm^2 led to massive death of the cells. Thus, there was a linear dependence of the amount of blocking of DNA replication on the dose. In studying the appearance of cells with chromosome aberrations the cells were irradiated with doses of 15, 30, 45, and 60 ergs/mm^2 in the S stage, in the period of high sensitivity to UV-irradiation, and fixed 10, 12, 14, and 16 hours after those doses, respectively. Comparison of the occurrence of cells with chromosome aberrations with the retardation of the cell cycle showed that even 15 ergs/mm^2 retards the cell cycle by about 3 hours. Author

N69-18362# Atomic Energy Commission, Washington, D. C. Div. of Technical Information

THE DEPENDENCE OF THE RADIOSENSITIVITY OF RATS ON INDIVIDUAL DIFFERENCES IN THE CALCULATED AND ACTUAL OXYGEN CONSUMPTION

L. Novak et al *In its* Radiobiol., Vol. 8, No. 1 1968 p 263–267 refs (See N69-18331 08-04)

Avail: CFSTI

Male Wistar rats in two groups 45 to 60 days old and one group 95 to 105 days old, after measurement of their respiratory metabolism level, were irradiated with doses of 600, 675, and 800 r at 50 r/minute for the respective groups, then kept in isolation without limitations on food or drink. The animals were weighed daily and deaths were recorded. The results confirm previous data on variation of body weight after nonlethal exposures as a function of the difference between the oxygen consumption measured in an experimental animal before irradiation and the theoretical consumption calculated from the minimum requirements of the organism to maintain thermal homeostasis. Author

N69-18363# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

THE PROPHYLACTIC ACTION OF EXOGENOUS INTERFERON CULTURES OF CHICK EMBRYO FIBROBLASTS AFTER X-RAY IRRADIATION

E. A. Lvovskii et al. *In its* Radiobiol., Vol. 8, no. 1, 1968 p 268-272 refs (See N69-18331 08-04)
Avail: CFSTI

Chicken interferon obtained by infection of 9 to 10 day embryos with virus of group A of strain PR_8 was introduced into the allantoic cavity in a quantity of 10^4 chicken embryo doses. The allantoic fluid was taken 72 hours later and purified of influenzal virus by centrifugation. The remaining virus was inactivated by heating and the obtained interferon was diluted with 30-fold hemohydrolyzate to reduce its activity. The preventive effect of the interferon was determined by its ability to inhibit the multiplication of vesicular stomatitis virus in normal and irradiated (200, 600, and 1800 rads of x-irradiation) cultures of chick embryonal fibroblasts. The antiviral activity of the interferon was reduced in the irradiated cultures in direct proportion to the dose and time elapsed between their irradiation and infection. Author

N69-18364# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
EXPERIMENTS ON THE IRRADIATION OF DUCKWEED (LEMNA MINOR L.) BY γ-RAYS AND FAST NEUTRONS
M. P. Leinerte *In its* Radiobiol., vol. 8, no. 1, 1968 p 273-276 refs (See N69-18331 08-04)
Avail: CFSTI

Duckweed was irradiated with doses of 250, 1000, 4000, 16,000, and 64,000 rads of γ-rays and physically equivalent doses of fast neutrons. After two months the number and weights of the plants were determined as percentages of a control. Very small doses of γ-rays (up to 4000 rads) had a very weak effect, even a tendency to increase the weight at 250 and the number at 4000 rads, and at 64,000 rads the number and weight were 30 to 40 percent of the control. Physically equivalent doses of fast neutrons had a much stronger effect: 80 to 90 percent of the weight and number of the control at 250 rads, 15 to 20 percent as 16,000, and 100 percent mortality at 64,000 rads. Author

N69-18365# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
CONTENT OF FREE SEMIQUINONE RADICALS AND THEIR PRECURSORS IN MAMMALIAN TISSUES DIFFERING IN RADIOSENSITIVITY
A. M. Kuzin et al. *In its* Radiobiol., Vol. 8, No. 1, 1968 p 277-280 refs (See N69-18331 08-04)
Avail: CFSTI

Tissues of the brain, muscle, kidneys, lungs, liver, and spleen of the bull, ram, and sow were frozen with liquid nitrogen and lyophilized to a moisture content of 1 to 2 percent. The EPR method was used to determine the quantity of free semiquinoid radicals in the tissue and the dynamics of their increase in the presence of moistened oxygen, which reveals the quantity of their predecessors capable of giving free semiquinoid radicals during oxidation. The results showed that decrease of susceptibility to radiation injury during irradiation correlates well with reduction of such predecessors. Author

N69-18366# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
THE SR-90 ACCUMULATION FACTOR IN PLANKTON OF DIFFERENT BODIES OF WATER
Z. K. Kaliniya et al. *In its* Radiobiol., Vol. 8, No. 1, 1968 p 281-283 refs (See N69-18331 08-04)
Avail: CFSTI

Tables are presented characterizing the plankton of a eutrophic, a mesotrophic-eutrophic, and a dystrophic lake in different months and their ^{90}Sr accumulation factors in the summer of 1966. A small calcium content in the water of the dystrophic lake (4-6 mg/liter) meant that its plankton had a larger capacity for ^{90}Sr accumulation than the plankton of the other types of lake. Author

N69-18367# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
RADIOBIOLOGY, VOLUME 8, NUMBER 2
1968 259 p refs Transl. into ENGLISH from Radiobiologiya (Moscow), v. 8, no. 2, 1968 p 1-285
(AEC-tr-6915-Vol-8-No-2) Avail: CFSTI

Radiobiological studies on man, animals, plants, and microorganisms are presented. Emphasis is placed on antiradiation drugs and genetic mutation effects. For individual titles, see N69-18368 through N69-18401.

N69-18368# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
QUANTITATIVE PRINCIPLES OF THE REALIZATION OF POTENTIAL DAMAGES IN IRRADIATED YEAST CELLS
Yu. G. Kapul'tsevich et al. *In its* Radiobiol., Vol. 8, No. 2, 1968 p 1-10 refs (See N69-18367 08-04)
Avail: CFSTI

Repair processes take place in irradiated yeast cells not only when they are incubated in starvation medium, but also in the case of postradiation culturing on nutrient media until potential damages have been realized, i.e., converted to an irreversible state. It was shown that the realization of potential damages does not occur simultaneously in all individuals of the population, and that in each cell it occurs within a rather short period of time during division of the nucleus. Consequently, there is some distribution of cells according to periods of realization of potential damages. This communication was devoted to an experimental determination of this distribution. Author

N69-18369# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
SUPPRESSION OF THE SYNTHESIS OF NEW TYPES OF RNA IN EMBRYOS OF PEA SEEDS BY IRRADIATION
S. R. Umanskii et al. *In its* Radiobiol., Vol. 8, No. 2, 1968 p 11-20 refs (See N69-18367 08-04)
Avail: CFSTI

The synthesis of various classes of RNA in the embryonic tissue of seeds begins almost with the first hours of swelling. The synthesis of the DNA-like fractions is sharply inhibited by irradiation, while the synthesis of rRNA, on the contrary, increases substantially. The decrease not only in the height, but also in the number of peaks of Au-type RNA, after irradiation led to the idea of a possible change in the set of active genes - repression of certain genes and activation of others under the influence of irradiation. The present work was undertaken to clarify this question. The method of artificial DNA-RNA hybridization is a reliable method, permitting an evaluation of the set of active genes. Using this method, we attempted to compare the RNA population in normal and irradiated tissue, as well as the RNA of embryonic tissue of seeds at various hours of swelling. Author

N69-18370# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
KINETICS OF THE HYDROLYSIS OF SODIUM PHENYLPHOSPHATE UNDER THE ACTION OF IRRADIATED ALKALINE PHOSPHATASE IN COMPARISON WITH THE ACTION OF NON-IRRADIATED ALKALINE PHOSPHATASE

E. B. Nikol'skaya *In its* Radiobiol., Vol. 8, No. 2 1968 p 21–28 refs (See N69-18367 08-04)
Avail: CFSTI

In this work we undertook to study the dependence of the enzymatic hydrolysis of PP under the action both of irradiated and of nonirradiated alkaline phosphatase, depending upon the substrate concentration, at pH 10.1. We were especially interested in the question of whether the position of the maximum on the curve of the initial rate versus substrate concentration, the composition of the inactive complex, the form of the kinetic equation, and the kinetic constants are changed by irradiation or not. . . . Author

N69-18371# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
EFFECTS OF IONIZING RADIATIONS UPON THE FREE AMINO ACID POOL IN NUCLEI ISOLATED FROM THE RAT THYMUS, SPLEEN, AND LIVER
L. P. Belavina *In its* Radiobiol., Vol. 8, No. 2 1968 p 29–35 refs (See N69-18367 08-04)
Avail: CFSTI

An increase in the aminonitrogen level in the nuclei of the rat thymus, spleen, and liver and individual changes in the free amino acid content were noted one and 24 hours after irradiation of the animals at a dose of 850 R. The following amino acids were identified in protein-free filtrates of nuclei isolated from the rat thymus, spleen, and liver: aspartic and glutamic acids, histidine, lysine, arginine, serine, alanine, glycine, leucine, phenylalaline, tyrosine, valine, and methionine. There is an increase in the aminonitrogen level in the nuclei of the thymus and spleen one and 24 hours after irradiation of the animals at a dose of 850 R. The aminonitrogen level in the liver nuclei is unchanged one hour after irradiation and increased after 24 hours. After irradiation the free amino acid content in the nuclei of the rat thymus, spleen, and liver experiences individual variations. Author

N69-18372# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
INFLUENCE OF GAMMA RADIATION ON PROTEIN BIOSYNTHESIS IN ISOLATED CHLOROPLASTS
K. D. Kolomiets et al *In its* Radiobiol., Vol. 8, No. 2 1968 p 35–42 refs (See N69-18367 08-04)
Avail: CFSTI

Gamma-radiation exerts a substantial influence upon protein biosynthesis in isolated chloroplasts, both at the early stages—two hours after irradiation of leaves, and at long-term stages in the case of irradiation of seeds. The nature of these disturbances was manifested in an inhibition of the incorporation of labeled carbon from alanine and malic acid into the proteins of the isolated chloroplasts. The presence of repair phenomena in the process of protein synthesis was demonstrated in chloroplasts isolated from one-month-old pea plants, grown from irradiated seeds. The analogous nature of the the disturbance of chloroplast protein biosynthesis in experiments in vivo and in vitro is evidence that apparently radiation damage to protein biosynthesis is due to the high radiosensitivity of the autonomous system that provides for protein formation, which is subjected to the action of γ-radiation. Author

N69-18373# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
SIGNIFICANCE OF THE CORTICOSTEROID HORMONES IN CHANGES IN THE ALANINE AMINOTRANSFERASE ACTIVITY IN THE BRAINS OF WHITE RATS DURING IRRADIATION BY X-RAYS AND INTERMEDIATE-ENERGY NEUTRONS
L. S. Cherkasova et al *In its* Radiobiol., vol. 8, no. 2 1968 p 43–52 refs (See N69-18367 08-04)
Avail: CFSTI

The article presents data on the rate of enzymatic transamination from alanine to ketoglutarate in the subcellular fractions of the brain after irradiation by X-rays and intermediate-energy neutrons at doses of 40 R and 13.5 rad, respectively, depending upon the initial functional state of the pituitary–adrenal cortex system. The rate of enzymatic transamination from alanine to ketoglutaric acid in the subcellular fractions of the brain is changed after a single whole-body irradiation by X-rays and intermediate-energy neutrons, at doses of 40 R and 13.5 rad, respectively. A great role in the changes in the alanine aminotransferase activity is played by the initial functional state of the pituitary–adrenal cortex system. Author

N69-18374# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
INFLUENCE OF HOT PARTICLES ON HUMAN CELLS
S. I. Tarasov et al *In its* Radiobiol., Vol. 8, No. 2 1968 p 53–62 refs (See N69-18367 08-04)
Avail: CFSTI

In view of the detection of hot particles in the atmosphere and in the air of industrial rooms, the need has arisen for investigating their biological hazard. Particles of cobalt-60 with an activity of 10^{-9} Ci/particle were used as a model of the hot particle. The investigation was conducted on human fibroblasts in tissue culture. Various methods of fixation of the cobalt particles were described. A laser apparatus was successfully used. The biological effects were established: an inhibition of mitosis and an increase in the frequency of chromosome rearrangements. Author

N69-18375# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
CORRELATION OF THE RADIOSENSITIVITY OF MICE OF DIFFERENT LINES WITH THE CONTENT OF SULFHYDRYL GROUPS IN THEIR HEMATOGENIC TISSUE
Lieh Suang Tu *In its* Radiobiol., Vol. 8, No. 2 1968 p 216–219 refs (See N69-18367 08-04)
Avail: CFSTI

A distinct positive correlation between the radiosensitivity of male mice of the three lines BALB/c, $CC_{57}Br$, and $C_{57}B1$ ($LD_{50/30}$ 390±14 R, 427±17 R, and 550±16 R, respectively) and the total content of sulfhydryl groups in spleen cells (1.722±0.040, 1.923±0.032, and 2.330±0.007 micromoles of SH-groups per 100 mg of tissue, respectively) was established. These data are considered as a confirmation of the concept relating the resistance of a biological object to ionizing radiation and its content of protein or low-molecular thiols. Author

N69-18376# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
CHANGE IN THE HAPTOGLOBIN CONCENTRATION IN THE BLOOD SERUM OF DOGS AND RATS DURING RADIATION SICKNESS
A. V. Pospelova et al *In its* Radiobiol., Vol. 8, No. 2 1968 p 69–75 refs(See N69-18367 08-04)
Avail: CFSTI

The change in the concentrations of haptoglobin and the α_2-fraction of the blood serum of dogs and rats during radiation sickness was studied in the work. The haptoglobin contents in the blood serum of dogs and rats was determined in the normal state and after irradiation. The haptoglobin concentration in the blood of

the animals increased as radiation sickness developed. The increase in the α_2-globulin fraction of the blood serum of dogs occurs chiefly on account of an increase in the haptoglobin level. Author

N69-18377# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

EVALUATION OF THE RESPONSE OF THE ISLET APPARATUS OF THE PANCREAS DURING EXPERIMENTAL ACUTE RADIATION SICKNESS

A. I. Barkalaya *In its* Radiobiol., Vol. 8, No. 2 1968 p 76-83 refs (See N69-18367 08-04)

Avail: CFSTI

During acute radiation sickness in rats, induced by γ-irradiation at doses of 600 and 700 R, histomorphological signs of functional overloading of the islet apparatus—hypertrophic and hyperplastic processes, in conjunction with pronounced degranulation of the β-cells—develop. At the same time, the glycogen level in the liver drops, and there is an excess deposition of lipids there. Daily administration of insulin to irradiated rats at a dose of 0.2 unit/kg substantially weakens the hypertrophic and hyperplastic response of the islet apparatus. The definite identity of the results permits us to believe that a definite role in the mechanism of the development of insufficiency of the function of the islet apparatus during radiation sickness is played, among other factors, by activation of the pituitary-adrenal system and the glycemic factor. Author

N69-18378# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

CONTENT OF LIPID PHOSPHORUS AND LIPID RADIOTOXINS IN THE TISSUES OF IRRADIATED RATS

O. S. Arutyunova et al *In its* Radiobiol., Vol. 8, No. 2 1968 p 84-92 refs (See N69-18367 08-04)

Avail: CFSTI

Directly after γ-irradiation of rats at doses of 700 and 1500 rad, a decrease in the amount of loosely bound phospholipids in the organs and tissues is observed. After irradiation of rats at a dose of 1500 rad on the third day, and after irradiation at a dose of 700 rad on the fourth to fifth day, an increase in the amount of loosely bound phospholipids was detected in comparison with the norm. The increase in the amount and activity of LRT in the initial period of the injury coincides with the period of breakdown of lecithin and cephalin and a general decrease in the amount of natural antioxidants-loosely bound phospholipids. The decrease in the amount and activity of LRT during the following period is accompanied by an increase in the amount of loosely bound phospholipids. Author

N69-18379# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

SIGNIFICANCE OF THE TIME FACTOR IN THE IRRADIATION OF IMAGO INSECTS (EXPERIMENTS ON GRANARY WEEVILS)

I. B. Bychkovskaya et al *In its* Radiobiol., Vol. 8, No. 2 1968 p 93-98 refs (See N69-18367 08-04)

Avail: CFSTI

In the work we analyzed the dependence of the survival rate of granary weevils upon the value of the radiation dose at various irradiation intensities. The death rate of granary weevils irradiated with the γ-rays of ^{60}Co in the dose rate range from 40 to 3.5 R/minute, differs little. When the irradiation intensity is changed only slightly from 3.5 to 2.2 and 1.5 R/minute, there is an abrupt drop in the vulnerability. Curves of the dependence of the survival rate of granary weevils upon the radiation dose at dose rates of 40-7 R/minute have a typical S-shaped form. At 2.2 and 1.5 R/minute, the S-shape is lost, and the curves become step-wise. An abrupt drop in the vulnerability of the weevils, as well as a distortion of the shape of the dose-versus-effect curve, occurs when a definite duration of irradiation is reached, equal to approximately three to five days (the "critical time"). Author

N69-18380# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

CYTOLOGICAL CHANGES IN THE EPITHELIUM OF THE MUCOUS MEMBRANE OF THE RAT SMALL INTESTINE UNDER THE PROLONGED INFLUENCE OF RADIONUCLIDES

L. Ya. Zhorno et al *In its* Radiobiol., Vol. 8, No. 2 1968 p 99-104 refs (See N69-18376 08-04)

Avail: CFSTI

The influence of chronic internal irradiation by radionuclides upon the state of the epithelium of the mucous membrane of the small intestines was studied in experimental rats of three groups, which received a mixture of isotopes with initial activity 15, 1.5 and 0.15 μCi/day. In the case of prolonged administration of radionuclides, an increase in the number of aberrant mitoses is noted in animals that received isotopes with initial activities of 15 and 1.5 μCi for 30 to 180 days. The time of appearance of the initial changes and their maximum development were directly dependent upon the amount of the isotope administered. A peculiarity of the cytological response of the intestinal epithelium in the experimental rats to the prolonged influence of radionuclides was a conservation of the cytogenetic effect for a long time after the intake of the isotopes ceased. Author

N69-18381# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

ON THE CHANGE IN THE REFLEXES FROM THE CAROTID SINUS DURING THE PRIMARY RESPONSE OF THE ORGANISM TO IRRADIATION

Yu. A. Lupachev *In its* Radiobiol., Vol. 8, No. 2 1968 p 105-111 refs (See N69-18367 08-04)

Avail: CFSTI

The work was devoted to a study of the dependence of the magnitude of the pressor sinocarotid reflexes in rabbits during the period of the primary response, developed after whole-body x-irradiation at a dose of 800 R, upon the method of induction of the reflex. During the period of the primary response to irradiation, clamping of the common carotid artery in rabbits leads to the appearance of perverted (depressor instead of pressor) responses. The elimination of shifting and tightening of the artery during the period of clamping leads to a disappearance of the perverted responses, but the magnitude of the reflex remains lower than in the control rabbits. It may be assumed that the cause of the appearance of perverted responses in the irradiated animals is an increase in the reflex excitability of the mechanoreceptors of the sinocarotid zone, which are stimulated when the walls of the carotid sinus are tightened. Author

N69-18382# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

SOME PECULIARITIES OF THE NEURON ACTIVITY OF THE OPTICAL REGION OF THE CEREBRAL CORTEX OF RABBITS SUBJECTED TO THE INFLUENCE OF IONIZING RADIATION DURING LATE EMBRYOGENESIS

I. A. Kolomeitseva *In its* Radiobiol., Vol. 8, No. 2 1968 p 112-120 refs (See N69-18376 08-04)

Avail: CFSTI

In the control rabbits and rabbits irradiated by x-rays (at a dose of 300 R) at the end of embryogenesis, the spontaneous

and induced pulsed activity of the neurons of the cortex of the visual analyzer was investigated. An increase in the frequency of the pulsed activity in the background was detected in comparison with the control, along with an increase in the group of cells with irregular discharges and a decrease in the probability of discharging in response to a flash. Author

N69-18383# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
TISSUE ANTIGENS IN THE BLOOD AND URINE OF ANIMALS DURING RADIATION SICKNESS
K. P. Kashkin et al *In its* Radiobiol., Vol. 8, No. 2 1968 p 121–129 refs (See N69-18367 08-04)
Avail: CFSTI

Radiation sickness of rats is accompanied by the appearance of tissue antigens of the liver and spleen in the blood of the animals. The penetration of these antigens into the blood is of a phase type and corresponds to the early periods of development of radiation sickness and to the period of development of autoinfectious processes. Among the various fractions of the cytoplasm of liver cells, the fractions of the cytoplasmic granules evidently are distinguished by the greatest radiosensitivity, and their antigens appear among the blood proteins of the animals soon after irradiation in large quantities and more often than other antigens. An index of radiation damages to cells of kidney tissue is the appearance of kidney antigens in the urine of the experimental animals soon after irradiation. Author

N69-18384# Atomic Energy Commission, Washington, D. C. Div of Technical Information.
COMPARATIVE STUDY OF THE INTRACELLULAR DISTRIBUTION OF S 35 CYSTAMINE IN THE LIVERS AND SPLEENS OF WHITE MICE AND RATS
V. G. Vladimirov *In its* Radiobiol., Vol. 8, No. 2 1968 p 130–136 refs (See N69-18367 08-04)
Avail: CFSTI

The use of the radioactive tracer method in conjunction with the method of differential centrifuging did not reveal any significant species differences in the intracellular distribution of ^{35}S-cysteamine in the tissues of the liver and spleen in white mice and rats. In experiments on mice it was shown that an increase in the dose of cysteamine leads to an increase in the content of the protector in all subcellular fractions of the liver and spleen. The latter is especially pronounced in the nuclei of cells of these tissues, and in the liver, moreover, in the mitochondria and microsomes. Author

N69-18385# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
PECULIARITIES OF EARLY REGENERATION OF MOUSE BONE MARROW IN VARIOUS VARIATIONS OF PARTIAL IRRADIATION
K. A. Fafanova et al *In its* Radiobiol., Vol. 8, No. 2 1968 p 137–146 refs (See N69-18367 08-04)
Avail: CFSTI

The early phase of restoration of the bone marrow of CBA mice after subtotal irradiation is characterized by a predominant acitivity of myelopoiesis and an extension of this response to the shielded portion of the hematogenic tissue. Here lies the essential distinction of this type of regeneration from regeneration after local irradiation, where there is a local activation of erythropoiesis. Both in the case of subtotal and in the case of local irradiation, the bone marrow lymphocytes respond to radiation damage and behave as a single system during regeneration, regardless of whether they are in the irradiated or in the shielded portion. It was hypothesized that the cause of the inversion of hematogenesis in the case of subtotal irradiation is a decrease in the pool of bone marrow lymphocytes, which perform the functions of "pre-erythroid" hematogenic cells; the direction of differentiation of the latter may be controlled by the spleen. Author

N69-18386# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
POSTRADIATION TRANSPLANTATION OF THE BONE MARROW FROM TOLERANT DONORS
I. N. Golovistikov *In its* Radiobiol., Vol. 8, No. 2 1968 p 147–157 refs (See N69-18367 08-04)
Avail: CFSTI

A method of lowering the frequency and severity of secondary sickness of radiation chimeras by using bone marrow from mice or rats in which immunological tolerance to tissues of the donors was induced in the adult state as the donor material was approved. Transplantation of foreign bone marrow from donors in which tolerance to tissues of the future recipients was induced in the adult state lowers the frequency and severity of secondary disease of radiation chimeras. The effect is more pronounced in the allogenic model (C57BL → C3H) than in the xenogenic model (Wistar → C3H). A single preliminary immunization of the donors (Wistar rats, C57BL mice) by spleen cells of the recipients (C3H mice) did not produce any significant changes in the expression of secondary sickness of radiation chimeras. Author

N69-18387# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
INVESTIGATION OF STERILIZING DOSES FOR EPHESTIA KUENNIELLA L. IN IRRADIATION IN VARIOUS STAGES OF DEVELOPMENT
N. I. Yusifov *In its* Radiobiol., Vol. 8, No. 2 1968 p 158–164 refs (See N69-18367 08-04)
Avail: CFSTI

Our investigation established the sterilizing doses of γ-radiation for various stages of development of *Ephestia Kuunniella* L. The lower radiosensitivity observed for the female at all stages of development gives a basis for assuming that it is associated with recovery processes occurring in the egg cell. A greater radiosensitivity of the fertilized egg cell was detected in comparison with the dormant germ cells before fertilization. In conclusion, I should like to express my gratitude to Corresponding Member of the Academy of Sciences USSR, A. M. Kuzin, for his attention and valuable advice while this investigation was being conducted. Author

N69-18388# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
BIOLOGICAL EFFECTS OF Po 210 IN THE CASE OF PERORAL ADMINISTRATION
Yu. I. Moskalev et al *In its* Radiobiol., Vol. 8, No. 2 1968 p 165–176 refs (See N69-18367 08-04)
Avail: CFSTI

In experiments on 386 female white rats we investigated the biological effects of polonium-210 in the case of peroral administration. The average lifetime of the rats, the changes in the blood picture, frequency and rates of appearance of mammary gland tumors were studied at doses of 0.01–2 μCi/g (total of seven doses). In the case of peroral administration, polonium-210 is ~20 times less toxic than in the case of intraperitoneal injection. The changes in the composition of the white blood cells (leukopenia, neutrophilesis and lymphocytopenia) depend chiefly upon the

amount of the isotope introduced, while erythropenia also depends upon the lifetime of the experimental animals. In the long-term periods, tumors of the mammary glands arise in the experimental rats considerably earlier and in a larger percentage of cases than among the control animals. Author

N69-18389# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

FORMATION OF DEEP DOSES IN THE SKIN IN THE CASE OF ITS CONTAMINATION BY β-γ EMITTERS

V. E. Zaichik *In its* Radiobiol., Vol. 8, No. 2, 1968 p 177–186 refs (See N69-18367 08-04)

Avail: CFSTI

Various models of infiltration of β-emitters into the skin were considered. A calculation of the distribution of dose rates according to depth of the skin was performed by the method of superpositions. The method consists of dividing the entire thickness of the skin into layers of 10–20 μ. For the corresponding scheme of penetration we determined the radioactivity present in each layer and assumed that this activity is distributed on a plane in the middle of this layer. The distribution of dose rates according to depth was determined from each layer on both sides according to the Levinger formula. Then the values of the dose rates from each layer at the same depth from the surface of the skin were summed. The results obtained permit an establishment of the possible variations of the dose rates at various depths of the skin arising as a result of infiltration of β-emitters with β-particle energies up to 3 MeV. Author

N69-18390# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

DEPENDENCE OF THE DEVELOPMENT OF IRRADIATED SEEDS ON THE TEMPERATURE OF GERMINATION

L. I. Lebedeva et al *In its* Radiobiol., Vol. 8, No. 2, 1968 p 187–196 refs (See N69-18367 08-04)

Avail: CFSTI

The relationship between the temperature and radiation effects is evidence of damage by penetrating radiation to the processes of metabolism controlling the integrity of the nuclear structures. Thus, according to the criterion of inhibition of the growth of rootlets in Indian mustard and peas that was used, the doses at which inactivation of such metabolic processes begins, like the lethal doses, differ by an order of magnitude. During postradiation storage of white mustard seeds, the value of the total injurious effect and the degree of radiation inhibition of recovery processes are reduced. In all probability, such correlations are evidence of a relationship between the general radiosensitivity and the sensitivity of recovery processes to the radiation influence. Author

N69-18391# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

INFLUENCE OF THE FORM OF NITROGEN ON THE MANIFESTATION OF RADIOBIOLOGICAL EFFECTS AFTER TREATMENT OF SEEDS WITH FAST NEUTRONS

G. V. Ponomarev et al *In its* Radiobiol., Vol. 8, No. 2, 1968 p 197–202 refs (See N69-18367 08-04)

Avail: CFSTI

The final radiobiological effects of treatment of seeds with fast fission neutrons can be modified by pre- and postradiation growth on reduced or oxidized forms of nitrogen. The reduced form of nitrogen proved to be more advisable in practice for obtaining the maximum number of fertile M_1 plants. On the basis of our work, it can be concluded that pre- and postradiation growth of seeds on the reduced form of nitrogen decreases the negative effect of fast neutrons. Author

N69-18392# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

INFLUENCE OF X-RAY IRRADIATION ON PHAGOCYTOSIS OF AVIAN-TYPE TUBERCULOSIS MYCOBACTERIA. (EXPERIMENTAL INVESTIGATION ON THE MODEL OF BEE MOTH LARVAE)

G. P. Demakov et al *In its* Radiobiol., Vol. 8, No. 2, 1968 p 203–207 refs (See N69-18367 08-04)

Avail: CFSTI

Bee moth larvae are a convenient model for studying the influence of x-ray irradiation in the phagocytosis of tuberculosis mycobacterium in the organism. Irradiation of the larvae at a dose of 50 R slightly inhibits the phase of absorption of mycobacteria but appreciably reduces the digestive ability of the hemolymph cells. Irradiation of bee moth larvae at a dose of 1000 R strongly inhibits both phases of phagocytosis–both absorption and decomposition of avian-type tuberculosis mycobacteria by the hemolymph cells. Author

N69-18393# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

ON THE SIGNIFICANCE OF CORTICOSTEROIDS IN THE REALIZATION OF THE LYMPHOLYTIC EFFECT OF IONIZING RADIATION

V. P. Fedotov et al *In its* Radiobiol., Vol. 8, No. 2, 1968 p 208–214 refs (See N69-18367 08-04)

Avail: CFSTI

The number of degenerating cells in the thymus, spleen, and lymph nodes after irradiation of rats at a dose of 150 R or their administration of corticosteroids was determined by luminescent microscopy. It was found that the radiation lympholytic effect is made up of the direct injurious action of γ-rays and a mediated influence through the hormones of the adrenal cortex. A comparison of the lympholytic effect with the corticosterone level in the blood indicated that the mediated action of radiation is not necessarily associated with an activation of the adrenal cortex and may develop against a background of physiological concentrations of corticoids. However, the presence of hormones is quite essential, since the damage to the lymphoid tissue is very slight in adrenalectomized animals. In the case of simultaneous application of irradiation and exogenous steroids, a summation of the lympholytic effects is noted. Author

N69-18394# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

FREQUENCY OF CHROMOSOME REARRANGEMENTS IN WHITE RATS DURING CHRONIC TREATMENT WITH CERIUM-144

R. I. Bikkulov *In its* Radiobiol., Vol. 8, No. 2, 1968 p 215–219 refs (See N69-18367 08-04)

Avail: CFSTI

The frequency of chromosome rearrangements in germ and somatic cells of white rats was studied after chronic intake of cerium 144 over a period of 6 months. For each rat, 250 cells from the testes, tibiae, and eyes were examined at the anaphase and telophase stages, and the number of cells with chromosome damages were statistically evaluated. In all investigated cell tissues a regular increase in the frequency of chromosome rearrangements and a decrease in it after the administration had ceased were observed. G.G.

N69-18395# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

INFLUENCE OF RADIOPROTECTORS ON THE PROCESSES OF BLOOD CLOTTING DURING ACUTE RADIATION SICKNESS IN GUINEA PIGS

O. Ya. Vorob'ev *In its* Radiobiol., Vol. 8, No. 2 1968 p 220–226 refs (See N69-18367 08-04)
Avail: CFSTI

The influence of the prophylactic administration of cystamine and mexamine on the porcesses of blood clotting was studied in experiments on guinea pigs. It was shown that in the development of the hemorrhagic syndrome of acute radiation sickness, there are substantial disruptions in the entire system of hemostasis. However, both protectors influence chiefly the first phase of blood clotting. In acute radiation sickness in guinea pigs, the recalcification time is sharply disturbed. Cystamine and mexamine exert a protective action upon the recalcification time; moreover, maxamine is more active. In acute radiation sickness, changes in the prothrombin index, the fibrinogen concentration, and the fibrinolytic activity are observed. Author

N69-18396# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
RADIOSENSITIVITY OF CERTAIN SPECIES OF WOODY PLANTS UNDER THE CONDITIONS OF BELORUSSIA
M. A. Kudinov *In its* Radiobiol., Vol. 8, No. 2 1968 p 227–230 refs (See N69-18367 08-04)
Avail: CFSTI

Dormant woody plant seeds were irradiated at various doses by gamma rays at a dose rate of 100 R/sec and the results of germination were evaluated statistically. Results showed that seeds of certain radiosensitive species lost their ability to give viable offspring at a dose of 5 kR, whereas radioresistant species grew well at a dose of 60 kR. Greatest radioresistance was observed in plants of mountain localities. Comparison of obtained data confirmed the hypothesis that radiosensitivities depended upon the size of the chromosomes. G.G.

N69-18397# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
CALCULATION OF DOSES ON THE INTESTINES IN SMALL LABORATORY ANIMALS
N. A. Zapol'skaya et al *In its* Radiobiol., Vol. 8 No. 2 1968 p 231–235 refs (See N69-18367 08-04)
Avail: CFSTI

Calculated were radiation absorption doses in intestine of white rats from oral administered cerium 144. The values for integrals of concentration with respect to time were found experimentally for rats under total starvation by graphically depicting the changes in activity in different portions of the gastrointestinal tract and by calculating the isotope concentration per gram mass of food in the various intestine sections. The absorbed dose depended upon the rate of passage of the isotope with the food, the fraction of activity that had been taken in, and the mass of contents in each portion of the gastrointestinal tract. G.G.

N69-18398# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
PRACTICAL RESULTS OF SELECTIVE BREEDING OF COTTON OF THE SPECIES GOSS. HIRSUTUM USING IONIZING RADIATION
M. K. K. Gulamov et al *In its* Radiobiol., Vol. 8, No. 2 1968 p 236–245 refs (See N69-18367 08-04)
Avail: CFSTI

Positive mutations of the cotton plant of the species *Goss. hirsutum* can be obtained under the influence of the γ-rays of ^{60}Co on the seeds. Useful cotton plants with a recessive mutation were obtained by irradiating the seeds at doses of 10–50 kR. The greatest mutagenesis was observed with respect to such characteristics and properties as early ripening, crude weight of one boll, fiber length, type of fruiting branches of the plants, and presence of limers on the seeds. The yield of mutations increases when the seeds are additionally treated with high temperature (90°), which makes it possible to obtain mutants, and at lower irradiation doses (1 kR). The deciding factor in the detection of recessive mutations is the second and third generations--M2 and M_3. The appearance of new mutations, differing from the original ones, is also noted in the offspring of subsequent generations. Author

N69-18399# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
A LARGE WELL-SHAPED SCINTILLATION DETECTOR
Yu. F. Koval' et al *In its* Radiobiol., Vol 8, No. 2 1968 p 246–248 refs (See N69-18367 08-04)
Avail: CFSTI

Design and performance of a scintillation detector for metabolic studies of radioactive isotopes in animals is described. The instruments uses a scintillation plastic connected to a photocathode with a voltage detector and cathode repeater assembly for photoelectronic multiplier. A voltage of 1375 V was selected for measuring activities of standards and of animal organs. Radiometry of rats in vivo produced a recording efficiency with respect to cesium-137 of about 20 percent. G.G.

N69-18400# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
DOSE ACCUMULATION FACTORS CLOSE TO A RADIATION SOURCE FOR WATER AND TISSUE-EQUIVALENT SUBSTANCES
V. E. Drozdov et al *In its* Radiobiol., Vol. 8, No. 2 1968 p 249–252 refs (See N69-18367 08-04)
Avail: CFSTI

A simple expression with one exponential factor is developed for calculating the radiation dose accumulation factor in water from a point isotopic source at 0.5 to 3 MeV energies and for 0 to 4 relaxation lengths thicknesses. The formula: $B = Ae^{\alpha\mu R} + (1-A)$ expresses in α and A certain coefficients for the given energies and substances; μR is the source-detector distance in relaxation lengths; $\mu(cm^{-1})$ is the linear attenuation factor; and R (cm) is the source-detector distance. An experimental verification of calculated accumulation factor values showed good agreement and did not exceed a discrepancy of $\pm$ 2.5 percent for Co^{60} radiation in water. G.G.

N69-18401# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
BIOLOGICAL EFFECTS OF IRRADIATION OF VARIOUS INTENSITIES
I. G. Akoev et al *In its* Radiobiol., Vol. 8, No. 2 1968 p 253–265 refs (See N69-18367 08-04)
Avail: CFSTI

We studied the clinical course of radiation sickness in dogs subjected to γ-irradiation of various intensities. Dose rates from 0.1 to 894 R/minute were used, or the dose was split into two to ten fractions. Special attention was paid to the clinical expression of the manifestations of the general primary response and the period of the height of the disease. Within the interval of dose rates studied, the average degree of injury decreased regularly with decreasing irradiation intensity. In the case of fractionated irradiation, the injurious effect of radiation increased with each fraction of irradiation up to a definite dose level. In the case of further irradiation, the manifestations of the primary responses were weakened or disappeared entirely. Author

N69-18402# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
RADIOBIOLOGY, VOLUME 8, NUMBER 3
1968 189 p refs Transl. into ENGLISH from Radiobiologiya (Moscow), v. 8, no. 3, 1968 p 1–204
(AEC-tr-696-Vol-8-No-3) Avail: CFSTI

Radiation effects in plants and animals, and the use of antiradiation drugs are discussed in the articles presented. For individual titles, see N69-18403 through N69-18425.

N69-18403# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
SOME ASPECTS OF THE PROTECTION OF NUCLEOPROTEINS FROM THE INFLUENCE OF IONIZING RADIATION
A. N. Pisarevskii et al *In its* Radiobiol., Vol. 8, No. 3 1968 p 1–11 refs (See N69-18402 08-04)
Avail: CFSTI

The comparative radiosensitivity of deoxyribonucleoprotein (DNP) was studied in the gel and condensed states. It was shown that the radioresistance of formed nucleoprotein strands is increased by one to two orders of magnitude. The introduction of a number of protective substances into a DNP gel leads to an increase in the critical dose leading to loss of the structure-forming properties. The best protective ability is possessed by AET and MPA and gallates. Irradiation of DNP gels by doses below the critical does not lead to any change in the number of structuromechanical properties, if protective substances are introduced into the DNP gels before irradiation. FINAM has the greatest activity. In the irradiation of condensed DNP structures, the change in the relaxation properties is entirely suppressed when AET and MPA are introduced into solution. Stepwise deproteinization of DNP leads to an increase in the radioresistance of the nucleoprotein. It is hypothesized that the lysine-enriched fraction of histone is responsible for the change in the structuromechanical properties of the nucleoprotein complex.
Author

N69-18404# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
INFLUENCE OF IRRADIATION ON THE COMPOSITION OF MESSENGER RNA DURING LOACH EMBRYOGENESIS
S. R. Umanskii *In its* Radiobiol., Vol. 8, No. 3 1968 p 12–22 refs (See N69-18402 18-04)
Avail: CFSTI

The population of RNA in normal and irradiated loach embryos was compared at various stages of development by the method of artificial DNA-RNA hybridization. It was shown that the activation of the new genes during early loach embryogenesis is accomplished periodically. The periods of activation of the genes coincide with the "periods of morphogenetic activity of the nuclei." Irradiation before the beginning of gene activation almost entirely suppresses this process, at the same time without producing a repression of already active genes.
Author

N69-18405# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
URINE PROTEINS DURING ACUTE RADIATION SICKNESS OF ANIMALS
G. A. Zedgenidze et al *In its* Radiobiol., Vol. 8, No. 3 1968 p 23–33 refs (See N69-18402 08-04)
Avail: CFSTI

The urine proteins of intact rats of the Avgust line and animals subjected to whole-body irradiation by the γ-rays of ^{60}Co, were subjected to an electro- and immunoelectrophoretic investigation. Cross-exhausted and unexhausted rabbit immune sera against urboproteins of intact and irradiated animals, as well as against proteins of the blood, mitochondria, microsomes, and hyaloplasm of kidney cells, were used to develop the electrophoretograms. In the uroproteins of the intact rats, six fractions differing in electrophoretic mobility were detected, containing 11 antigens, five of which were represented by blood serum proteins, while six were uroproteins specific for the urine, also determined in the proteins of the hyaloplasm and microsomes of kidney cells. Radiation sickness of the animals is accompanied by phase changes in the kidney function. An increased excretion of protein with the urine is observed at the early stage of radiation sickness and during the height of the disease in cases of autoinfectious complications.
Author

N69-18406# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
INFLUENCE OF GALASCORBIN ON THE RESPIRATION AND OXIDATIVE PHOSPHORYLATION OF LIVER MITOCHONDRIA AFTER IRRADIATION OF ANIMALS
E. F. Shamrai et al *In its* Radiobiol., Vol. 8, No. 3, 1968 p 34–38 refs (See N69-18402 08-04)
Avail: CFSTI

In radiation sickness, disturbances of the intracellular metabolism are observed, including the energy metabolism, lying at the basis of all the vital processes. The question of the influence of ionizing radiation upon the processes of tissue metabolism and oxidative phosphorylation has been insufficiently studied. In this study, the indices of the energy metabolism were determined after various types of irradiation (local and total) and various doses (sublethal and lethal). Also determined was the possibility of influencing these processes by the use of a physiological complex of vitamins C and P, galascorbin.
Author

N69-18407# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
POSTRADIATION CHANGES OF MOUSE AND RAT BONE MARROW CELLS DURING INCUBATION IN VITRO
L. A. Kharlamova *In its* Radiobiol., Vol. 8, No. 3 1968 refs p 39–46 refs (See N69-18402 08-04)
Avail: CFSTI

The dynamics of the inactivation, death, and lysis of bone marrow cells were studied in nonirradiated and irradiated suspensions incubated at 37° *in vitro*. The dynamics of inactivation (loss of ability for unlimited multiplication) of hematogenic stem cells in mouse bone marrow suspensions were determined by the method of spleen colonies. Death and lysis of nucleated cells was judged according to the decrease in the number of cells that were not stained by eosin and were not lysed. It was established that the kinetic principles of these processes are the same. Irradiation at a dose of 100 and 190 R led to an acceleration of the inactivation of those stem cells which retained their ability for unlimited division immediately after irradiation. An acceleration of the processes of death and lysis of nucleated cells *in vitro* was observed only in the case of irradiation at doses of 1000 R and more.
Author

N69-18408# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
STUDY OF THE DIRECT AND REMOTE EFFECTS OF RADIATION ON BONE MARROW
A. L. Vygodskaya et al *In its* Radiobiol., Vol. 8, No. 3 1968 p 47–59 refs (See N69-18402 08-04)
Avail: CFSTI

Cell destruction and the change in the number of cells of different fractions in rat bone marrow under the influence of

direct and remote action of radiation during the first two days after irradiation at a dose of 1000 R with one limb shielded were studied. The existence of remote influences of radiation upon hematogenic tissue, manifested in a substantial cell destruction in the shielded bone marrow, was established. It was shown that the remote effect is due to a sharp decrease in the number of erythroid cells and a certain decrease in the number of myeloid cells. The number of lymphocytes in the shielded bone marrow does not change significantly. The causes of the drop in the number of cells of different fractions of the shielded and irradiated bone marrow are analyzed. A substantial change in the quantitative and qualitative composition of the bone marrow was detected under the action of nonspecific stress influences, manifested in a redistribution of cells between the bone marrow and blood during the early periods after the influence. Author

N69-18409# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

COMPARATIVE STUDY OF THE EFFECTS OF X-RAY AND GAMMA-RADIATION ON THE SURVIVAL OF RATS UNDER CONDITIONS OF NONUNIFORM INFLUENCES

G. M. Avetisov *In its* Radiobiol., Vol. 8, No. 3 1968 p 60–65 refs (See N69-18402 08-04)

Avail: CFSTI

The peculiarities of the biological effects of X-ray and γ-radiations were demonstrated. A consideration of the spatial distribution of the tissue doses makes it possible to explain the qualitative and quantitative peculiarities of the course of radiation injury in nonuniform fields. In a comparison of the biological effectiveness of different types of radiations, a strict consideration of the spatial distribution of doses is needed. The radiobiological effect of the γ-radiation of ^{60}Co in comparison with X-rays (Δ = 1.31 mm Cu) according to the criterion $LD_{50/30}$ is equal to 1. Author

N69-18410# Atomic Energy Commission, Washington, D. C. Div of Technical Information

RECOVERY OF FETUS AND PLACENTA AFTER RADIATION INFLUENCE

V. E. Kogan *In its* Radiobiol., Vol. 8, No. 3 1968 p 66–74 refs (See N69-18402 08-04)

Avail: CFSTI

The change in the state of fetuses and placentas was studied 3–7–9 days after irradiation of female rats on the tenth day of pregnancy at a dose of 25 R (on the 13th, 17th, and 19th days of pregnancy). It was shown that on the 13th day of pregnancy, the vascularization of the fetal placenta is reduced, and the lifetime of the fetuses under conditions of total oxygen starvation is shortened (69.7 min in the experimental group, compared with 104.9 min in the control). Subsequently, a gradual repair of the vascular disorders in the placenta is observed: by the 17th day of pregnancy, no underdevelopment of the fetal vascular network in the labyrinth portion of the irradiated placentas is detected. Normalization of the response of the fetuses to total oxygen starvation does not set in until the 19th day of pregnancy. Thus, together with high radiation vulnerability of the fetus, a substantial ability for repair is detected. Author

N69-18411# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

RADIOSENSITIVITY OF DEVELOPING TENCH EMBRYOS (TINCA TINCA L.)

I. V. Kulikov et al *In its* Radiobiol., Vol. 8, No. 3 1968 p 75–81 refs (See N69-18402 08-04)

Avail: CFSTI

The effects of aqueous solutions of $^{90}Sr - ^{90}Y$ and external irradiation by the γ-rays of cobalt-60 on the embryonic development of the tench were studied. Incubation of fertilized tench roe in aqueous solutions of $^{90}Sr - ^{90}Y$ with a concentration from 10^{-10} to 10^{-5} curie/liter has no appreciable effect on the rate of development of the embryos or on quantitative yield of normal and abnormal prelarvae. The survival rate of the prelarvae for ten days after hatching from the roe incubated in radioactive water does not differ from the control. The prelarvae that hatched from the roe incubated in radioactive solutions proved to be just as resistant to supplementary external γ-irradiation (dose 800 R) as the controls. A single external γ-irradiation of the roe at the stage of early cleavage increases the yield of anomalous prelarvae at a dose of 50 R; the total yield of prelarvae, however, is unchanged in comparison with the control up to 200 R. A dose of 400 R is absolutely lethal. The prelarvae hatched from the roe subjected to irradiation of 200 R subsequently died considerably more rapidly than in the control; doses from 25 to 100 R did not produce any appreciable deviations. Author

N69-18412# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

RADIOSENSITIVITY OF THE MEMBRANES OF ISOLATED NUCLEI OF NERVE AND GLIAL CELLS

K. Sh. Nadareishvili et al *In its* Radiobiol., Vol. 8, No. 3 1968 p 82–91 refs (See N69-18402 08-04)

Avail: CFSTI

The kinetics of the hypotonic and alkaline decomposition of isolated nuclei obtained from the brains of four-week-old rats were studied. The nuclei were isolated by the method of Shobe with modifications. A suspension of nuclei in an isotonic sucrose solution was irradiated at 1.5–2°C, diluted with 0.25% neutral or alkaline NaCl solution, and analyzed at room temperature. The nuclei in suspension were counted microscopically and with an electronic particle counter. A statistically significant radiation effect is detected at 500 R for nuclei of astrocytes and at 1000 R for the nuclei of neurons and oligodendrocytes. The rate of hypotonic and alkaline lysis of nuclei increases almost up to 30 kR. At a dose of 40 kR or more, the effect of irradiation is reduced, i.e., the osmotic stability of the nuclear membranes increases sharply. With all other conditions equal, the nuclei of the astrocytic glia are more sensitive to irradiation than the nuclei of the neurons and oligodendrocytes, which should be due to the higher functional and metabolic activity. Author

N69-18413# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

PHYSIOLOGICAL ANALYSIS OF THE ROLE OF SYNAPSE DISTURBANCES OF THE ACTIVITY OF THE NEUROMUSCULAR APPARATUS AFTER IRRADIATION

A. E. Ul'yanitskaya *In its* Radiobiol., Vol. 8, No. 3 1968 p 92–98 refs (See N69-18402 08-04)

Avail: CFSTI

In irradiation of a neuromuscular preparation of m. sartorius n. ischiadicus of the frog at a dose of 18–20 krad, a distinct decrease in the work capacity of the muscle begins, detectable according to its contraction in response to stimulation of a motor nerve. At the same time, in the case of direct stimulation the work capacity of the muscle does not differ from the norm. A dose of 18–20 krad does not produce any changes either in the threshold of excitation or in the action potential of the nerve. The action potentials of the muscle in the case of stimulation of a motor nerve become lower than in the control, while in the case of direct stimulation of the muscle they are higher. Producing an initial deterioration of the work of the muscle in response to stimulation of a motor nerve, such a dose does not lower the work capacity either of the motor nerve or of the the excitable muscle membrane.

Consequently, a disruption of the myoneural synaptic transmission is responsible for the primary injurious effect observed immediately after irradiation. Author

N69-18414# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

SOME DISPUTED QUESTIONS IN THE PROBLEM OF POSTRADIATION RECOVERY OF THE CHROMOSOMES

N. V. Luchnik *In its* Radiobiol., Vol. 8, No. 3 1968 p 99–111 refs (See N69-18402 08-04)

Avail: CFSTI

In this article, the term recovery is used to denote nonrealization of latent damages, here limited to the cytogenetic level. Evidence is cited against the idea that the formation of observable chromosome aberrations is based upon true breaks. Most of the facts support the correctness of the template theory. The impossibility, without making more or less arbitrary assumptions, of determining the rate of recovery and time of realization using existing facilities was demonstrated. The results of experiments indicating that cellular and local recovery involves processes that occur at the presynthetic and synthetic stages of the cellular cycle, respectively, were analyzed. Possible molecular mechanisms of both types of recovery are discussed. Author

N69-18415# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

LUMINESCENCE-CYTOCHEMICAL INVESTIGATION OF THE EFFECTS OF GAMMA-RAYS AND RADIOTOXINS ON CELLS OF EHRLICH ASCITES CARCINOMA

V. G. Kondratenko et al *In its* Radiobiol., Vol. 8, No. 3 p 112–121 refs (See N69-18402 08-04)

Avail: CFSTI

The effects of γ-rays and quinoid radiotoxins on Ehrlich cancer cells were studied. Using a cytofluorimetric method, it was shown that in the development of radiation damage to cellular nuclei, there is an almost complete analogy both under the action of ionizing radiation and under the action of radiotoxins. It was established that there is a dose and time dependence, and in the case of the action of radiotoxins a concentration dependence as well, in the development of radiation reactions in the DNA-protein complex of the nuclei. The effects of radiation anabolites upon cellular nuclei begin to be manifested practically simultaneously with the effects of radiation. It is concluded that the role of a starter mechanism is played by the action of the ionizing rays, and an important role is played by the effects of radiation anabolites. Author

N69-18416# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

ELECTROLYTE COMPOSITION OF THE BLOOD PLASMA AND LIQUOR IN RABBITS IRRADIATED AFTER PROPHYLACTIC ADMINISTRATION OF CYSTAMINE

A. G. Kuzovkov et al *In its* Radiobiol., Vol. 8, No. 3 1968 p 122–127 refs (See N69-18402 08-04)

Avail: CFSTI

The content of sodium, potassium, and calcium ions in the spinomedullar fluid and in the blood plasma taken from the carotid artery and medullar venous sinus was studied in experiments on rabbits by the method of flame photometry. The indices of the calcium content reflect the total value of ionized and bound calcium. Irradiation of the animals is accompanied by pronounced hypokalemia and a slightly increased sodium level. Cystamine administered before irradiation normalizes the potassium metabolism in the animal organism after irradiation and somewhat increases the sodium and calcium ion content in the blood in this case. Author

N69-18417# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

RELATIONSHIP BETWEEN THE FLUORINE AND CALCIUM CONTENTS IN THE DIET AND THE RESISTANCE OF ANIMALS TO THE INFLUENCE OF GAMMA-IRRADIATION

V. A. Knizhnikov et al *In its* Radiobiol., Vol. 8, No. 3 p 128–134 refs (See N69-18402 08-04)

Avail: CFSTI

The significance of the level of intake of calcium and the trace element fluorine with the diet for the radioresistance of animals to single and fractionated whole-body α irradiation was studied in chronic experiments on 312 noninbred white rats. It was established that a diet enriched in calcium and fluorine substantially increases the radioresistance of the animals. Author

N69-18418# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

EXPERIMENTAL STUDY OF THE EFFECTIVENESS OF CYSTAMINE IN CASE OF PROLONGED INFLUENCE OF GAMMA-RAYS ON RATS

D. I. Zelyakova *In its* Radiobiol., Vol. 8, No.3 1968 p 135–139 refs (See N69-18402 08-04)

Avail: CFSTI

The radioprotective action of cystamine and that of cystamine with amygdalin in various doses and courses of administration at a dose rate of 16.7 R/hour up to a total dose of 2000 R was studied on 140 rats. The indicated dose produces 80–100% death of the animals within a 30-day period. The administration of the preparations before the beginning of irradiation and repeated administration during irradiation at a daily dose of 150 mg/kg are ineffective. Repeated administration in a daily dose of 450 mg/kg has a pronounced toxic effect. The causes of the ineffectiveness of cystamine under conditions of the irradiation model were studied. Author

N69-18419# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

RESTORATION OF RADIATION DAMAGES TO COTTON SEEDS DURING PROLONGED STORAGE

N. M. Berezina et al *In its* Radiobiol., Vol. 8, No. 3 1968 p 140–145 refs (See N69-18402 08-04)

Avail: CFSTI

It was established that cotton seeds irradiated at the lethal dose of 40 kR show a restoration of viability when they are stored for prolonged periods under laboratory conditions. All the seeds freshly irradiated at this dose die in the stage of the cotyledon leaves. Seeds stored for 6 and 12 months after irradiation develop true leaves, buds, and bloom. The restoration of viability is paralleled by a restoration of a whole series of physiological and biochemical disorders, arising in the freshly irradiated seeds: the chlorophyll content is restored, as is the activity of oxidative enzymes, and the content of radiotoxins is reduced. Author

N69-18420# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

JOINT ACTION OF GAMMA-IRRADIATION AND THERMAL SHOCKS ON A ARABIDOPSIS THALIANI (L) HEYNH. SEEDS

Ch. V. Nikolov et al *In its* Radiobiol., Vol. 8, No. 3 1968 p 146–153 refs (See N69-18402 08-04)

Avail: CFSTI

Air-dried seeds were subjected to γ-irradiation at doses of 40, 80, 120, and 160 kR, as well as to a temperature of 100°C for 30 minutes. Thermal shocks were applied before, after, or before and after irradiation. In the control and experimental groups of plants, death of the plants in the phases of the cotyledons and rosette, growth of the root and stem, the rate of passage

through the basic phases of development, and fertility were studied. Postradiation thermal shocks intensified the effects of irradiation, while preradiation and double shocks weakened them. The possible mechanisms of the influence of thermal shocks upon the radiobiological responses of seeds are discussed. Author

N69-18421# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
INFLUENCE OF TRACE ELEMENTS ON THE SENSITIVITY OF SEEDS TO FAST FISSION NEUTRONS
G. V. Ponomarev *In its* Radiobiol., Vol. 8, No. 3 1968 p 154 – 160 refs (See N69-18402 08-04)
Avail: CFSTI

Within the range of fast fission neutron tissue doses up to 600 rad, no changes could be established in the radiosensitivity of barley seeds preliminarily germinated on a medium with an increased amount of boron. Preliminary germination on a medium with an increased amount of zinc increases the resistance of the seeds to fast fission neutrons. Preliminary germination against a background of polyvalent cations mination (Fe, Mn, Co) increased the sensitivity of the seeds to fast fission neutrons. A relationship was noted between the increase in the radiosensitivity of the seeds and the maximum valence of the metal ions. Author

N69-18422# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
USE OF THE "STEBEL" GAMMA-APPARATUS IN EXPERIMENTAL RADIOBIOLOGY
T. G. Ratner et al *In its* Radiobiol., Vol. 8 No. 3 1968 p 161–166 refs (See N69-18402 08-04)
Avail: CFSTI

The dose distribution within the working chamber of the "Stebel" apparatus was studied with a radioactive charge of ^{137}Cs, which broadens the possibility of utilizing it in radiobiological experiments where it is necessary to know the exact dose distribution over the volume being irradiated. The dose distribution was measured in air and a tissue equivalent phatom by chemical dosimetry. The dose rate in the center of the chamber can be varied from 750 to 100 rad/minute with the aid of inserted lead shields. By considering the parameters studied, good reproducible conditions of irradiation and accuracy of dosimetry can be ensured. Author

N69-18423# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
MUTAGENIC EFFECTS OF RADIOTOXINS
A. M. Kuzin et al *In its* Radiobiol., Vol. 8, No. 3 1968 p 167–170 refs (See N69-18402 08-04)
Avail: CFSTI

The investigation indicated that quinoid radiotoxins extracted from γ-irradiated plant tissue, acting upon *E. coli* K-12 (λ), induced the formation of auxotrophic mutants. With the procedure used, 12 mutants were formed on 1000 investigated colonies, as compared with 0.6 in the control. The mutants obtained required: proline and serine; serine, alanine, and glycine; serine and xanthine; leucine; leucine, valine, and roline; tryptophan. A large frequency of appearance of proline deficiency was noted (8 out of 16). Author

N69-18424# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
ON THE ROLE OF ADRENAL CORTEX IN THE MECHANISM OF THE RADIOPROTECTIVE ACTION OF TESTOSTERONE
B. B. Moroz et al *In its* Radiobiol., Vol. 8, No. 3 1968 p 171–175 refs (See N69-18402 08-04)
Avail: CFSTI

The change in the corticosterone content in the blood plasma and in the tissues of the adrenals was investigated in intact and irradiated rats under conditions of protection with testosterone propionate. A single administration of testosterone three or ten days before irradiation prevents an increase in the corticosterone level in the height of radiation sickness, exerts a radioprotective effect, and makes the course of the disease lighter. The mechanism of the protective action of testosterone is associated with a change in the function of the adrenal cortex during radiation sickness. Author

N69-18425# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
RADIOACTIVITY OF THE RINGED SEAL
N. V. Sokolova et al *In its* Radiobiol., Vol. 8, No. 3 1968 p 176–179 refs (See N69-18402 08-04)
Avail: CFSTI

This work present presents data on the strontium 90 and cesium 137 content in various organs and tissues of the ringed seal *Pusa hispida ochotensis* Pall. from Sea of Okhotsk in 1966. The strontium 90 concentrations in the bones of the seal were 13–28 pCi/kg of crude weight, in the muscles 0.6-1.5, and in the liver 1.1-1.4. The γ radiation of the seal organs and tissues was due chiefly to potassium 40 and cesium 137. Author

N69-18489*# California Univ., Davis. Dept. of Human Physiology.
MUSCLE TRAINING AND BLOOD FLOW
Masahiro Kaneko, R. F. Walters, and L. D. Carlson 15 Jan. 1969 298 p refs
(Grant NGR-05-004-026)
(NASA-CR-99770) Avail: CFSTI CSCL 06S

Nine male subjects ranging in ages from 18 to 21 years participated in isometric or isotonic training conducted to determine the effects on blood flow and other performance characteristics of the circulatory system, such as venous compliance. Muscle changes were induced by three weeks of exercises following isometric training schedules. The isotonic training was adjusted to comparable levels. The muscle strength before and after conditioning was determined by characterization of circumference, maximum tension, maximum tension endurance, and force velocity. The effect of muscle conditioning on the muscle circulation was characterized by measurements of the resting blood flow, blood flow following arterial occlusion, after isometric exercises, and after isotonic exercises. Extensive numerical results are presented in tables and graphs. K.W.

N69-18490*# Minnesota Univ., Minneapolis. Space Science Center.
ENVIRONMENTAL MICROBIOLOGY AS RELATED TO PLANETARY QUARANTINE Semiannual Progress Report
Dec. 1968 69 p ref
(Grant NGL-24-005-160)
(NASA-CR-99761; SAPR-1) Avail: CFSTI CSCL 06M

Progress in five research projects is summarized in this report. Four of the projects are concerned with behavior and survival of the *Bacillus subtilis* var. *niger* spores; the last project deals with the detection of low levels of microbial contamination on surfaces by chemical methods and determination of the relative percentages of living and dead cells. The behavior and survival of the spores was experimentally studied at temperatures below 60°C, in controlled air flow, and under conditions of heat-fixing at 80°C. The effects of humidity, location, surface finish, and separator thickness on the heat destruction of the spores when located between mated surfaces were also investigated. Experimental procedures, equipment, and results are presented for each study. K.W.

N69-18566 New York Univ., N.Y.
SCANNING: FUNCTION OF DISTANCE-ACUITY AND ARRAY STRUCTURE
Robert Fudin (Ph.D. Thesis) 1967 148 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-10055

Identical alphabetical material tachistoscopically presented in the right visual field (RVF) and left visual field (LVF), successively, are more easily recognized in the RVF. Targets are presented in the two fields such that the distance between target center and the fixation point (FP) are equated. This finding has been used in support of Hebb's notion of a cell assembly. In reading English, the next words to be encoded are usually to the right (in the RVF). As a result of this selective visual attention process, highly developed cell assemblies are established which mediate recognition of material exposed in the RVF more efficiently. When a word is exposed in the RVF, (1) its SP is easier to detect because it falls on an area of greater visual acuity, (2) the scanning process reaches the SP with less delay since it is located closer to the FP, and (3) the first half of the word, the more important part for total word recognition, falls on an area of greater visual acuity. These advantages allow scanning of the after-stimulation of these arrays to start with less delay. This factor is critical because the after-stimulation is rapidly losing its potential information. Dissert. Abstr.

N69-18567 Iowa Univ., Iowa City.
UNIT RESPONSES OF THE CAT COCHLEAR NUCLEUS TO AMPLITUDE-MODULATED STIMULI
Theodore Joseph Glattke (Ph.D. Thesis) 1968 164 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-10654

Two populations of units were defined on the basis of their spectral sensitivity. Low-frequency units were considered to be those with characteristic frequencies (CFs) of 800 Hz or less, and high-frequency units were those with CFs higher than 800 Hz. In the case of low-frequency units, stimuli were presented with low-frequency periodicity, but with spectra controlled to minimize low-frequency energy. High-frequency units were provided with stimuli consisting of the CF of each modulated at rates of 1000 interruptions per second. Tuning curves for the modulated stimuli were derived for both low-frequency and high-frequency units. In addition, some units were studied using modulated noise stimuli. Dissert. Abstr.

N69-18668*# Naval Radiological Defense Lab., San Francisco, Calif.
HEMATOLOGICAL RESPONSE IN SHEEP GIVEN PROTRACTED EXPOSURES TO Co 60 GAMMA RADIATION
E. T. Still, S. T. Takata, E. J. Ainsworth, G. F. Leong, and J. F. Taylor [13 Feb. 1969] 17 p refs
(NASA Order A-94806)
(NASA-CR-73286) Avail: CFSTI CSCL 06R

The changes in the total leukocytes in sheep irradiated with ^{60}Co gamma at a rate of 1.9 R/hr have been determined. After 50 R total exposure, maximum depression occurred 24 hours later. After 100 R or 175 R, maximum depression occurred within one hour. Recovery to control values was seen by 6–9 days for all three exposure groups. The recovery pattern for the circulating leukocytes was qualitatively the same for each of the three groups. An early lymphopenia was seen in all the groups, with recovery to the normal by 5–8 days. The percentage of neutrophils was greatly increased during the first 5 days. The data indicate that total leukocyte counts may not be a reliable means of predicting the exposure an animal sustains under protracted irradiation conditions. Author

N69-18680 Arkansas Univ., Fayetteville.
STUDIES ON THE RADIATION RESPONSE OF L CELLS UNDER ENERGY DEPRIVATION
James Lynn Sanders (Ph.D. Thesis) 1968 91 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-9619

Cultured mammalian cells of the L type show a brief, accelerated uptake of radioactive precursor into both deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) following relatively low doses of 250 kVp X-rays. This response appeared for cells being starved in a glucose-free salt solution and for cells treated with a 2, 4-dinitrophenol. Three distinct features characterize the response. First, a relatively fixed postirradiation time delay seems necessary before the accelerated labeling of the nucleic acids occurs. Second, the labeling of of DNA fraction closely parallels the labeling of the RNA fraction. Finally, the radioactive label appears to enter and then to leave both nucleic acid fractions. Survival studies indicated that cells treated with 2, 4-dinitrophenol had an increased resistance to X-rays. Consequently, the radiation-induced nucleic acid synthesis may represent a cellular mechanism for recovery from radiation injury. Dissert. Abstr.

N69-18722*# Bolt, Beranek, and Newman, Inc., Van Nuys, Calif.
COMBINATION EFFECTS OF TONE AND DURATION PARAMETERS ON PERCEIVED NOISINESS
Karl S. Pearsons Washington NASA Feb. 1969 49 p refs
(Contract NAS1-7461)
(NASA-CR-1283) Avail: CFSTI CSCL 06P

Three series of judgment tests were conducted to investigate the effects on perceived noisiness of tone content and duration parameters. Time patterns for the stimuli employed in the tests were triangular in shape to simulate aircraft flyover time histories. Stimuli for the first test included durations of 4, 12, and 32 seconds measured 10 dB below the maximum level of the stimulus. Tone-to-noise ratios in 1/3 octave bands for the stimuli at 2000 and 4000 Hz were varied to include 10 and 25 dB and no tone. In the second test stimuli included recordings of test stand turbofan engine noise using the same time history shape and durations mentioned above. The third test utilized pure-tone and broadband noise spectra like those used in the first Test, however, the duration of the tone differed from the duration of the noise, and the maximum level of the tone did not always occur at the same point in time as the maximum level of the noise. Author

N69-18767# National Physical Lab., Teddington (England). Div. of Computer Science.
SUBJECTIVE CHANGES IN THE PERCEPTION OF CONSONANTS WHEN PRESENTED AS 'STABILISED AUDITORY IMAGES'
C. R. Evans and Jacqueline Wilson Nov. 1968 9 p refs
(COM-SCI-41) Avail: CFSTI

When a single consonant is repeated continuously through earphones connected to an endless loop tape for ten minutes, many subjects begin to hear other consonants. As the first phantom word chosen is often the aspirant 'H', further experiments using nonsense words are planned. ESRO

N69-18991*# Albert Einstein Coll. of Medicine, New York.
SENSORY, PERCEPTUAL, AND PHYSIOLOGICAL ASPECTS OF SENSORY DEPRIVATION
Sidney Weinstein *In* Va. Polytech. Inst. Proc. of the Conf. on the Role of Simulation in Space Technol., Pt. D [1965] 25 p refs
(See N69-18988 08-11)
(Grant NsG-489)
Avail: CFSTI CSCL 06S

The effects of sensory deprivation and their implication for space travel are discussed, including spatial disorientation, the autokinetic effect, and size constancy. Research in sensory deprivation on man and animals, and some of the usual techniques employed, are described. Chemical studies and the effects of drugs are briefly mentioned. Sources and characteristics of stimuli are defined. Some of the aspects of a research program and the categories of sensory change which an astronaut might undergo in his capsule, or an experimental subject in his cubicle, are outlined. K.W.

N69-18992*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF LOW-GRAVITY ON PHYSIOLOGICAL PROCESSES
Siegfried J. Gerathewohl *In* Va. Polytech. Inst. Proc. of the Conf. on the Role of Simulation in Space Technol., Pt. D [1965] 36 p refs (See N69-18988 08-11)
Avail: CFSTI CSCL 06S

The major problems involved in low-gravity experimentation are discussed, and available data on the effects of prolonged weightlessness are summarized. The effects of weightlessness on physiological functions during or after orbital flights are discussed in some detail, based on results from flights conducted by the United States and the USSR. Personal experiences of the astronauts, operational performance, sensory and neurophysiological functions, respiratory functions, cardiovascular functions, the general metabolism, energy, physical strength, and reentry stress tolerances are specifically discussed. The results indicate that certain neurophysiological and physiological functions of the astronauts and cosmonauts were affected by the zero-G conditions, but no changes in their health were noted during flight. The symptoms observed in postflight examinations are also discussed. K.W.

N69-18993*# Naval Air Development Center, Johnsville, Pa.
EFFECTS OF HIGH-GRAVITY ON PHYSIOLOGICAL PERFORMANCE
Randall M. Chambers *In* Va. Polytech. Inst. Proc. of the Conf on the Role of Simulation in Space Technol., Pt. D [1965] 71 p refs (See N69-18988 08-11)
Avail: CFSTI CSCL 06S

The effects of high gravity on the physiological and psychological performance capabilities of man are summarized, and some of the major simulation studies which have concentrated on these aspects are reviewed. The emphasis is on specific data pertaining directly to manned spacecraft systems under development and test, although some simulation studies which have attempted to provide specific information in support of projects Mercury, Dyna-Soar, Gemini, and Apollo are also mentioned. The material is limited to problems involving high sustained linear accelerations. Acceleration environments and their effects on the psychophysiological performance of human subjects are discussed, and astronaut acceleration training programs and space flight simulations are summarized. In conclusion, 17 general principles are presented which describe the effects of high gravity on man. Future research needs are indicated. K.W.

N69-18994*# Republic Aviation Corp., Farmingdale, N. Y.
CLOSED ATMOSPHERES
George A. Albright *In* Va. Polytech. Inst. Proc. of the Conf. on the Role of Simulation in Space Technol., Pt. D [1965] 64 p refs (See N69-18988 08-11)
Avail: CFSTI CSCL 14B

The physiological and engineering problems associated with a closed environment and the life support system design requirements for future manned space systems are discussed. The role of simulation in determining man's physiological tolerance, in developing, testing, and qualifying a life support system and subsystems, and in establishing that man can survive and perform as man-machine integrator of the manned space system is briefly pointed out. Specifically covered are facility requirements, emergency recompression incidents, selection of atmospheres, oxygen toxicity, the Gemini atmosphere validation program, inert gases, atmosphere contaminants, and future life support systems. K.W.

N69-19007 Columbia Univ., New York.
STUDIES OF THE RIBONUCLEOPROTEIN PARTICLES IN RELAXED MUTANTS OF ESCHERICHIA COLI
Sawsan Amin Nofal (Ph.D. Thesis) 1967 82 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-8605

The presence of enzymes which methylate ribosomal RNA has been demonstrated. These methylating enzymes are ubiquitous and species specific. *In vivo* methylation of the ribonucleoprotein particles formed during methionine starvation of *E. coli* $K_{12}W6$ was also studied. Methylation of these particles occurs before they rearrange to normal ribosomes. Dissert. Abstr.

N69-19023*# National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, DECEMBER 1968
Jan. 1969 195 p refs
(NASA-SP-7011(58)) Avail: CFSTI CSCL 06

Subject coverage concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Each entry consists of a standard citation accompanied by its abstract. Author

N69-19033*# National Aeronautics and Space Administration, Washington, D. C.
HEAT PROBLEMS IN SPACE MEDICINE [PROBLEMI TERMICI IN MEDICINA SPAZIALE]
Paolo Rota Feb. 1969 11 p refs Transl. into ENGLISH from Italian Conf. Proc. Presented at 8th Intern. Tech. and Sci. Conf. on Space, Rome, 1–3 Apr. 1968
(NASA-TT-F-12058) Avail: CFSTI CSCL 06S

The thermal characteristics of space flight and of the general principles of heat regulation are discussed. The physiological and technical criteria which govern the conditioning and thermal protection of space vehicles and clothing are treated. The limits of physical and psychic resistance to elevated temperatures and the pertinent screening, training, and acclimatizing problems are considered. Author

N69-19039# New England Inst. for Medical Research, Ridgefield, Conn.
A STUDY ON CROSSOVER AND LEADING EDGE TIMING METHODS
S. J. Tao and A. Ogata Sep. 1968 18 p refs
(Contract AT(30-1)-3661)
(NYO-3661-13) Avail: CFSTI

The practical resolutions obtained from both crossover and leading edge timing methods are compared with their theoretical resolutions. Practical resolution of about 200 psec may be obtained from both methods. However, for large dynamic range, crossover timing is superior. Author (NSA)

N69-19055*# California Univ., Berkeley. Space Sciences Lab.
TECHNOLOGY AND MORALS, AN OLD STORY
Ida R. Hoos Nov. 1968 25 p refs *Its* Internal Working Paper No. 90
(Grant NGL-05-003-012)
(NASA-CR-100032) Avail: CFSTI CSCL 05K

The problems of controlling the rapid growth of twentieth century technology are discussed, with emphasis on the moral and ethical responsibilities facing modern society. Topics discussed include the use of nuclear energy for war and peace, progress in medical technology, such as the capability of organ transplants from one human to another, and the hazards of air pollution from industrial and radioactive contaminants. A.C.R.

N69-19088# Joint Publications Research Service, Washington, D. C.
SPACE BIOLOGY AND MEDICINE, VOLUME 2, NO. 6
5 Mar. 1969 141 p refs Transl. into ENGLISH from Kosmich. Biol. i Med. (Moscow), v. 2, no. 6, 1968 p 3–96
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N69-19090# Joint Publications Research Service, Washington, D. C.
PHYSICOCHEMICAL SYNTHESIS OF MONOSACCHARIDES FROM THE PRODUCTS OF HUMAN VITAL FUNCTIONS
Yu. Ye. Sinyak *In its* Space Biol. and Med., Vol. 2, No. 6 5 Mar. 1969 p 9–20 refs (See N69-19088 08-04)
Avail: CFSTI

The physicochemical synthesis of carbohydrates from the wastes of vital human functions is carried out through several intermediate reactions; the mandatory stage is the production of formaldehyde which during condensation yields carbohydrates. The wastes are first mineralized under pressure and the resulting carbon dioxide is mixed with hydrogen and used to synthesize methanol for further oxidation into formaldehyde. Included is a diagram of the physiochemical synthesis at increased pressure. G.G.

N69-19091# Joint Publications Research Service, Washington, D. C.
COMBINED EFFECT OF SPACE FLIGHT FACTORS ON THE "KOSMOS-110" ARTIFICIAL EARTH SATELLITE ON PLANTS
D. F. Gertsuskiy et al *In its* Space Biol. and Med., Vol. 2, No. 6 5 Mar. 1969 p 21–28 refs (See N69-19088 08-04)
Avail: CFSTI

This paper presents data characterizing the effect exerted on plants by spaceflight factors involved in flight of the "Kosmos-110" biosatellite. The plants grown from seeds flown aboard the "Kosmos-110" biosatellite grew and developed faster, giving a higher yield than the controls. In comparison with the controls on earth the flight plants contained larger amounts of ascorbic acid and a higher percentage of water, although the sugar content was similar. These results cannot be attributed solely to the effect of ionizing radiation. They appear to be a combined result of space factors involved in the "Kosmos-110" flight. Author

N69-19092# Joint Publications Research Service, Washington, D. C.
IMPAIRMENT OF CELL DIVISION IN BONE MARROW OF RATS IRRADIATED BY 50-MeV PROTONS
R. D. Govorun *In its* Space Biol. and Med., Vol. 2, no. 6 5 Mar. 1969 p 29–35 35 p (See N69-19088 08-04)
Avail: CFSTI

The processes of cell division and depletion of bone marrow of rats exposed to whole-body irradiation by 50-MeV protons were studied. The irradiation was shown to disturb mitotic activity and division of bone marrow cells and to cause destructive changes. The changes in mitotic activity and number of aberrant mitoses and

cells with nuclear destruction were observed for seven days after the exposure. The dose dependence of the number of aberrant cells and the value of the mitotic index were investigated one day after irradiation. A linear dose dependence of the number of aberrant mitoses was established for the dose range 100–550 rad. No significant differences were observed between the biological effect of 50-MeV protons and Co^{60} gamma rays. The relative biological effect is 1 or somewhat greater for the analyzed tests. Author

N69-19093# Joint Publications Research Service, Washington, D. C.

EFFECT OF A SIMULATED MARTIAN ENVIRONMENT ON CERTAIN ENZYMES

Ye. V. Belikova et al *In its* Space Biol. and Med., Vol. 2, No. 6 5 Mar. 1969 p 36–45 refs (See N69-19088 08-04)

Avail: CFSTI

The resistance of enzymes, RNAse, amylase and trypsin, to a simulated Martian environment was investigated. It was found that in the simulated Martian atmosphere, insolation excluded, solutions of the tested enzymes were better preserved than on the earth at 4°C. After the introduction of the insolation factor the tested enzymes were activated as a result of a four-hour exposure to the Martian environment. The enzymes can be arranged in the order of their stability as follows: amylase, RNAse, trypsin. When added to the enzymic solutions glycerin produced a stabilizing effect on all the enzymes in the simulated Martian environment, excluding the insolation factor, and exerted a protective effect on RNAse and trypsin, with the insolation factor taken into account. The pigments carotene and melanin served as protectors for the enzymes tested against the activating UV effect in the simulated Martian environment. Author

N69-19094# Joint Publications Research Service, Washington, D. C.

IMMUNOLOGICAL AND HISTOCHEMICAL STUDY OF REACTIVITY OF MICE EXPOSED TO A HYPEROXIC ATMOSPHERE

A. S. Kaplanskiy et al *In its* Space Biol. and Med., Vol. 2, No. 6 5 Mar. 1969 p 46–52 refs (See N69-19088 08-04)

Avail: CFSTI

Immunological and histochemical methods were used for studying the reactivity of mice exposed for 20 days to an atmosphere with $pO_2 = 304$ mm Hg. It is shown that an increased oxygen content in the breathed air produces no effect either on the rate of formation of antibodies or on the resistance of immunized mice to Salmonella typhimurium, at the same time decreasing the phagocytic activity of neutrophilis and increasing that of macrophages. A long-term exposure of animals to a hyperoxic environment resulted in a loss in weight of the body and lymph nodes and appearance of lymphoid tissue irritation. Author

N69-19095# Joint Publications Research Service, Washington, D. C.

EFFECT OF HIGH OXYGEN CONCENTRATIONS ON CONDITIONED REFLEX ACTIVITY AND BIOELECTRIC ACTIVITY OF SOME CORTICAL REGIONS AND SUBCORTICAL FORMATIONS IN RABBITS

N. A. Agadzhanyan et al *In its* Space Biol. and Med., Vol. 2, No. 6 5 Mar. 1969 p 53–62 refs (See N69-19088 08-04)

Avail: CFSTI

A conditioned food-procuring reflex to the rhythmic flashing of a light was formed in rabbits. After conditioning the assimilation of the rhythm was recorded in the optical cortex and lateral area of the hypothalamus. The animals were exposed to a 96% oxygen atmosphere at 760 mm Hg. During the first two days the unconditioned and conditioned foot-procuring reflexes were inhibited and assimilation of the rhythm was recorded in the optical cortex, ventromedial nucleus of the hypothalamus and reticular formation of the midbrain. This can be attributed to the excitation of adrenergic mechanisms of the nonspecific activating system. On the third-fourth days the unconditioned and conditioned responses and assimilation of rhythm disappeared. Predominance of theta- and alphalike activity and bursts of hypersynchronized waves were registered on the EEG. Author

N69-19096# Joint Publications Research Service, Washington, D. C.

EFFECT OF DIETS CONTAINING UNICELLULAR ALGAE ON METABOLISM RECOVERY IN PROTEIN-DEFICIENT WHITE RATS

N. S. Klyushkina et al *In its* Space Biol. and Med., Vol. 2, No. 6 5 Mar. 1969 p 63–70 refs (See N69-19088 08-04)

Avail: CFSTI

Experiments were conducted to study the effect of diets containing a bleached biomass of unicellular algae as the only protein source on the recovery of metabolic processes in rats kept on protein-deficient diets. It was demonstrated that the algal diets promoted recovery to the same extent as the control diet containing casein, surpassing the effect of a protein diet containing soya. Author

N69-19097# Joint Publications Research Service, Washington, D. C.

THEORETICAL APPROACHES TO THE SELECTION OF PHYSIOLOGICAL PARAMETERS FOR MEDICAL MONITORING DURING MANNED SPACE FLIGHT

Yu. G. Nefedov et al *In its* Space Biol. and Med., Vol. 2, No. 6 5 Mar. 1969 p 71–84 refs (See N69-19088 08-04)

Avail: CFSTI

This paper discusses theoretical approaches to the selection of optimum physiological parameters required to diagnose and predict the health conditions of crew members during space flight. The authors also describe the criteria which can be used in selecting the most informative parameters and give their detailed physiological analysis. In addition, the article describes some methods for evaluating the physiological information, including a covariance analysis which allows quantizing of the effects of certain spaceflight factors on the human body. Author

N69-19098# Joint Publications Research Service, Washington, D. C.

COORDINATION STRUCTURE OF MAN'S VOLUNTARY MOVEMENTS OF DIFFERENT COMPLEXITY ON A KEPLERIAN FLIGHT TRAJECTORY

I. F. Chekirda *In its* Space Biol. and Med., Vol. 2, No. 6 5 Mar. 1969 p 85–95 refs (See N69-19088 08-04)

Avail: CFSTI

Certain stages in the reorganization of the coordination structure of man's voluntary movements during short-term weightlessness were established. This made it possible to conduct a cyclographic analysis of the speed with which movements of different complexity can be adjusted to the zero gravity environment. It is shown that adaptation first involved movements at the synergy level, followed by those of the spatial field level, and finally movements of the level of objective actions. Author

N69-19099# Joint Publications Research Service, Washington, D. C.
EFFECT OF AGE, OCCUPATION AND PHYSICAL TRAINING ON HUMAN TOLERANCE TO LONG-TERM ACCELERATIONS
P. M. Suvorov *In its* Space Biol. and Med., Vol. 2, No. 6 5 Mar. 1969 p 96–103 refs (See N69-19088 08-04)
Avail: CFSTI

The effect of age, occupation and physical training on human tolerance to long-term accelerations ($\pm G_z$ and $+G_z$) was investigated. A total of 427 test subjects, including fighter pilots, engineers, physicians and research workers, were used in the experiments. The lowest tolerance was found in test subjects in the age range 20–24 and the highest tolerance in subjects in the age range 30-34. Test subjects in the age range 40–49 exhibited a reduced tolerance to accelerations. Certain differences in acceleration tolerance and the pattern of physiological reactions were found between pilots and representatives of other occupations. Athletes, gymnasts, weight-lifters and acrobats exhibited a better tolerance than long-distance runners, football players and skiiers who exhibited a tolerance level similar to that of persons who do not regularly participate in sports. Author

N69-19100# Joint Publications Research Service, Washington, D. C.
TIME PERCEPTION DURING BRIEF WEIGHTLESSNESS
V. I. Lebedev et al *In its* Space Biol. and Med., Vol. 2, no. 6 5 Mar. 1969 p 104–110 refs (See N69-19088 08-04)
Avail: CFSTI

The perception of time intervals by astronauts and test subjects under brief weightlessness conditions during parabolic flights was studied. Compared was the accuracy of estimating time intervals when experiencing weightlessness with the accuracy of time estimates during performance of similar tasks in horizontal flight. Results confirmed the dependence of time perception on human emotional states; during positive emotions under weightlessness conditions a subjective acceleration of time passage was observed. G.G.

N69-19101# Joint Publications Research Service, Washington, D. C.
HUMAN TOLERANCE TO ACCELERATIONS AT REDUCED BAROMETRIC PRESSURE
A. S. Barer et al *In its* Space Biol. and Med., Vol. 2, No. 6 5 Mar. 1969 p 111–119 refs (See N69-19088 08-04)
Avail: CFSTI

The tolerance of humans exposed to accelerations at a low atmospheric pressure was studied in centrifuge experiments. Back-to-chest accelerations of 4 to 12 g were applied at an angle of 78° to the long axis of the body. During the first run the cabin atmosphere was equivalent to altitudes of 3,000, 4,000, and 5,000 m. During the second run the test subjects were exposed to accelerations of 8 and 12 g, breathing gas mixtures with a reduced oxygen content. During the third run the test subjects were exposed to a pure oxygen environment equivalent to altitudes of 8,000 and 10,000 m. The human tolerance to accelerations was found to decrease with a pO_2 reduction in the breathed air. Certain regularities were noted in the changes of physiological function evaluated by recording electrocardiograms, tidal air volume, oxyhemoglobin, visual acuity, rheoencephalograms and plethysmograms. Author

N69-19102# Joint Publications Research Service, Washington, D. C.
SOME INDICES OF STATE OF THE CARDIOVASCULAR SYSTEM IN HEALTHY PERSONS
M. L. Kolomiyevskiy *In its* Space Biol. and Med., Vol. 2, No. 6 5 Mar. 1969 p 120–126 refs (See N69-19088 08-04)
Avail: CFSTI

Clarified are selection methods for groups of practically healthy persons when conducting cardiological studies without rigorous definition of reliable selection criteria. Mean indices were obtained for the state of protein and lipid metabolism and also for bioelectric and contractive functions of the myocardium from EEG's, polycardiograms, lecithin and cholesterol levels, and protein and lipoprotein fractions in blood serums. Data were statistically processed and showed in a number of practically healthy persons latently transpiring, sympton-free atherosclerosis. G. G.

N69-19103# Joint Publications Research Service, Washington, D. C.
CHANGES IN MYOCARDIAL REPOLARIZATION IN HEALTHY PERSONS DURING RESTRICTION OF MOTOR ACTIVITY
B. A. Korolev *In its* Space Biol. and Med., Vol. 2, No. 6 5 Mar. 1969 p 127–134 refs (See N69-19088 08-04)
Avail: CFSTI

A repolarization disturbance is indicated by development of the $T_{V_1} > T_{V_6}$ syndrome and appearance or increase in the amplitude of the U wave. It can also be suggested by changes in the ratio of the U and T amplitudes and change in the length of the aT–aU and S–aU segments, as well as by the RR/S–aU ratio. The standard values of these parameters for healthy persons were established in 1963. The U wave is well pronounced in the U_3 lead. Therefore, the U and T amplitudes, U/T and RR/S–aU ratios and the aT–aU and S–aU segments were analyzed, attention also being given to the $T_{V_1} > T_{V_6}$ syndrome. A hypoxia test was used in studying the repolarization process in 16 healthy male test subjects exposed to long-term hypodynamia. This condition causes shifts in myocardial repolarization. Author

N69-19115*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ANALYSIS OF THE OPERATION OF A MASS MEASURING SYSTEM IN AN ORBITING SPACECRAFT
Bruce A. Conway Washington Feb. 1969 28 p refs
(NASA-TN-D-5039) Avail: CFSTI CSCL 06B

An analysis of the operation of a mass measuring system, which is based on the oscillating spring mass principle, aboard a spacecraft is made. This analysis considers the dynamic effects of the oscillating device on an uncontrolled spacecraft by developing the equations of motion for the system. An approximate solution of these equations is then deduced, and a simple analytic expression for the maximum attitude error is found. Numerical integration of the equations of motion was performed on a digital computer for some typical measurement operations. Comparison between the approximate and exact solutions for these cases was very close. Results showed small (less than 0.02°) attitude errors arising from the operation of this device. Author

N69-19125# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
IONIZING RADIATION: SURVEY AND CONTROL TECHNIQUES
W. P. Howell 19 Sep. 1968 8 p Presented at Electromagnetic Spectrum Conf., Richland, Wash.
(BNWL-SA-2108; CONF-680930-3) Avail: CFSTI

Control of exposure to ionizing radiation is discussed. Limitation of exposure time, use of maximum practicable distance between the radiation source and the exposed individual, and the use of shielding are fundamental considerations. Radiation instruments, survey techniques, and errors in measurement are discussed. NSA

N69-19126# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
ELECTROMAGNETIC SPECTRUM: IONIZING RADIATION, SOURCES OF EXPOSURE
W. L. Fisher 19 Sep. 1968 7 p Presented at Electromagnetic Spectrum Conf., Richland, Wash.
(BNWL-SA-2109; CONF-680930-2) Avail: CFSTI

A general discussion of radiation sources of exposure to both laboratory personnel and large populations is presented. It is pointed out that education of the user is essential for preventing radiation sources from being radiation exposures to man. NSA

N69-19139# Federal Aviation Administration, Washington, D. C. Office of Aviation Medicine.
BIOMEDICAL APPLICATIONS OF A COMMERCIAL CAPACITANCE TRANSDUCER
Edward Podolak, James B. Kinn, and Edwin E. Westura Mar. 1968 12 p refs
(AM-68-3) Avail: CFSTI

A capacitance displacement transducer with a linear response and constant sensitivity for a frequency range of 0–1,000 hertz is described. Its application to measurement of chest wall motions was verified using static displacements from flat and curved surfaces and both human tissue and metal. The transducer has been used to obtain recordings of apex motion, heart sounds, brachial and radial pulses. Its advantages are that it is non-contacting and linear; that it has a wide frequency response and can easily be calibrated to obtain quantitative data of actual motion. Problems encountered in use were the mechanical positioning of the probe including respiratory motions in the measurements and the need to insulate the probe with a film of thin plastic to insure against an electrical hazard to the subject. Author

N69-19161*# National Aeronautics and Space Administration, Washington, D. C.
INVESTIGATIONS ON THE INDUCTION OF DORSIVENTRALITY IN FERN PROTHALLIA [UNTERSUCHUNGEN UBER DIE INDUKTION DER DORSIVENTRALITAT BEI DEN FARNPROTHALLIEN]
Kurt Bussmann Nov. 1966 50 p refs Transl. into ENGLISH from Jahrb. Wiss. Botanik (West Ger.), v. 87, 1939 p 565–624
(NASA-TT-F-10376) Avail: CFSTI CSCL 06C

The greatest possible variety of fern genera with varying prothallial developments was used in the experiments. Several Polypodiacea, (mostly Adiantum cuneatum and also Aspidium Filix), were selected but mostly Osmundacea, Osmunda regalis, and the Parkeriacea, Ceratopteris thalictroides. Detailed treatment is given to the characteristics of prothallial development, the methodology, and the orientation of the apical cell of young prothallia. Author

N69-19162*# National Aeronautics and Space Administration, Washington, D. C.
INVESTIGATION OF THE INDUCTION OF DORSIVENTRALITY OF APOGAMIC FERN PROTHALLIA [UNTER SUCHUNGEN UEBER DIE INDUKTION DER DORSIVENTRALITAET BEI APOGAMEN FARNPROTHALLIEN]
Kurt Bussmann Oct. 1966 20 p refs Transl. into ENGLISH from Jahrb. Wiss. Botan. (West Ger.), v. 89, 1941 p 615–636
(NASA-TT-F-10375) Avail: CFSTI CSCL 06C

A study was made of the factors that induce dorsiventrality in an apogamic stock of fern prothallial which is believed to be a hybrid between Dryopteris Filix mas and D. paleacea. There was general agreement with what is found in connection with sexual prothallia. In apogamic prothallia, dorsiventrality is induced by the following factors: (1) Light. Inducement of the dorsal side proceeds towards the light (positive response). (2) Substrate. Inducement of the dorsal side proceeds for sexual fern prothallia toward the substrate (positive response). (3) Gravity. It turns the dorsal sides towards the zenith (negative induction). In nature, the inducing effect of light is strongest. There is a long-lasting effect after induction of apogamic prothallia; reversal of dorsiventrality is only possible in young apogamic prothallia. Author

N69-19163*# National Aeronautics and Space Administration, Washington, D. C.
CONTRIBUTIONS TO THE PHYSIOLOGY OF STRENUOUS PHYSICAL WORK. PART 9: HYPERTHERMIA AND BASAL METABOLISM [BEITRAGE ZUR PHYSIOLOGIE SCHWERER KOERPERLICHER ARBEIT. 9 MITTEILUNG: HYPERTHERMIE UND RUHESTOFFWECHSEL]
E. Hohwue Christensen Jan. 1967 8 p refs Transl. into ENGLISH from Arb. Physiol. (West Ger.), v. 7, 1934 p 120–129
(NASA-TT-F-10669) Avail: CFSTI CSCL 06S

Experiments on correlation between body temperature and metabolism during heavy physical work, in comparison to diathermy treatment, are discussed. Oxygen consumption increased by 10.8% on an increase in rectal temperature by 1°C, partly due to increased cardiac, respiratory, and glandular activity. Rectal temperature maximum occurred 20 to 40 min after stopping the supply of heat in diathermy treatments and only a few minutes after stopping physical work, indicating a better temperature compensation of the body in active physical work, due to accelerated circulation, than in passive diathermy. Author

N69-19302*# Southwest Research Inst., San Antonio, Tex.
SOUTHWEST RESEARCH INSTITUTE ASSISTANCE TO NASA IN BIOMEDICAL AREAS OF THE TECHNOLOGY UTILIZATION PROGRAM Quarterly Progress Report, 1 Jul.–30 Sep. 1968
Ray W. Ware, Louis S. Berger, and Felix L. St. Claire, III 15 Oct. 1968 54 p
(Contract NASw-1714)
(NASA-CR-100022; QPR-3) Avail: CFSTI CSCL 06

The status of all biomedical problems handled during this period is reported. The requestor's formulation and proposed steps toward solution are given for each of the problems. All documents furnished to the participants of the program are listed. The difficulties that are encountered in attempts to transfer NASA-derived technology as part of the Technology Utilization program to scientists in the biomedical fields are briefly discussed. K.W.

N69-19329*# National Aeronautics and Space Administration, Washington, D. C.
CHANGE IN THE UNSPECIFIC REACTION OF THE ORGANISM DURING ADAPTATION TO HEAT
D. Schwarz Mar. 1968 54 p refs Transl. into ENGLISH from DFL Rept. 65-63
(NASA-TT-F-11575) Avail: CFSTI CSCL 06S

Under extreme environmental conditions such as occur in aviation or mining, man is subject to different types of stress. Adaptation to each individual type of stress involved is often not possible or, at least, very expensive. The present study attempts to prove that adaptation to one special type of stress (heat) will as well increase resistance against other types of stress (hypoxia, work, cold). Author

N69-19369# Joint Publications Research Service, Washington, D. C.
BIONICS

S. N. Braynes et al 3 Feb. 1969 26 p refs Transl. into ENGLISH from Kibernetiku Na Sluzhbu Kommunizmu (Moscow), v. 5, 1967 p 197–213
(JPRS-47360) Avail: CFSTI

Bionics research in Russia is divided into five areas and the results of some of this research are briefly summarized. Analysis of the papers connected with investigation of receptors and analyzers indicated that along with detailed study of the visual and auditory analyzer, more attention is being given to the study of the specific receptors of taste, smell, and tactile sense, electric voltage receptors, etc. Another area of research is the simulation of the neurons, nerve networks, nerve centers, and principles of organization of the brain in order to find means of utilizing the studied principles and technical systems. The third area constitutes the study of the mechanisms of orientation, navigation and range, and detection developed in the process of long term evolution of the animal world and the utilization of the organizational principles of these mechanisms for the construction of small size and reliable technical systems. Other aspects of bionic research include biomechanics and bioenergetics and the bionics aspects of the man–machine problem. B.P.

N69-19376# Joint Publications Research Service, Washington, D. C.
THEORY AND DESIGN OF EJECTION-TYPE ATOMIZER
S. A. Glukhov 6 Feb. 1969 13 p refs Transl. into ENGLISH from Med. Tekhn. (Moscow), Nov.–Dec. 1968 p 20–26
(JPRS-47395) Avail: CFSTI

Theoretical and experimental design data are presented on an ejection-type atomizer for aerosol therapy equipment. Equations are formulated to obtain the series of parameters affecting the process of liquid atomization by these atomizers. Consideration is also given to the interrelations and the reciprocal influence of geometric and physical parameters, and the most important functional characteristics of aerosol apparatuses as determined by the choice and operating conditions of the atomizer. These include the working air pressure and air flow rate, mean mass radius of aerosol particles and gravimetric determination of their size, and flow rate of the atomized liquid. The necessity of calibrating the atomizer for each and every medicine is emphasized. M.G.J.

N69-19383# Japan Atomic Energy Research Inst., Tokyo.
DETERMINATION OF TRACE ELEMENTS IN DNASE I BY THE ACTIVATION ANALYSIS
Asako Waki et al Dec. 1968 9 p refs Transl. into ENGLISH from Dobutsugaku Zasshi Zasshi (Tokyo), v. 76, no. 7, Jul. 1967 p 235–239
(NSJ-Tr-141) Avail: CFSTI

Commercially available DNase I (bovine pancreatic) was activated by exposing to a neutron flux of approximately 5×10^{12} n/cm^2/sec for 30 minutes. Then, γ-rays from ^{24}Na, ^{27}Mg, and ^{56}Mn, and β-rays from ^{32}P derived from the nuclear reaction ^{32}S(n,p)^{32}P were detected. By counting these radio activities, contents of these elements in DNase I were determined. The results were as follows: Na: 0.275–1.675 μg/mg-DNase I, Mg:0–13.25 μg/mg-DNase I, and Mn:0.105–0.150 μg/mg-DNase I. These elements could easily be removed by dialyzing DNase I against redistilled water. Author

N69-19422*# Research Triangle Inst., Durham, N. C. Engineering and Environmental Sciences Div.
BIOMEDICAL APPLICATIONS OF NASA SCIENCE AND TECHNOLOGY Quarterly Progress Report, 15 Sep.–14 Dec. 1968
James N. Brown, Jr. et al 14 Dec. 1968 72 p refs (Contract NSR-34-004-056)
(NASA-CR-100026; RTI-EU-411-1; QPR-2) Avail: CFSTI CSCL 06

The NASA-supported Biomedical Application Team at the Research Triangle Institute identified 6 new problems, performed significant activities on 15 of the active problems identified previously, performed 5 computer searches of the NASA Aerospace literature, and maintained one current awareness search. As a partial result of these activities, one technology transfer was accomplished. As a part of continuing problem review, 13 problems were classified inactive. Activities involved all phases of team activity with respect to biomedical problems. The numbers of new problems identified and transfers and potential transfers were relatively low during this quarter. Most of the activities were directed toward obtaining information related to problems already identified. Author

N69-19423# Norwegian Defence Research Establishment, Kjeller.
STUDIES OF THE LETHAL EFFECTS OF X-RAYS ON ESCHERICHIA COLI
Ivar Johansen Sep. 1968 57 p refs
(PD-5802; NDRE-56) Avail: CFSTI

The lethal effects of X-rays on *E. coli* were investigated. Evidence is presented that radiation-induced injuries in the cell content of deoxyribonucleic acid are responsible for reproductive death. Radiation chemical reactions which modify cellular response to radiation were studied. The mode of action of various substances in protection or in sensitization of cells to radiation is discussed. Author

N69-19429*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROJECT ENGINEERING DIVISION
In its Space Programs Sum. No. 37-54, Vol. 3, Oct.–Nov. 1968 31 Dec. 1968 P 37–39 refs (See N69-19427 08-34)
Avail: CFSTI CSCL 06M

The effect of low numbers of microorganisms on samples assayed by NASA standard procedures is discussed, and the accuracy of extrapolation using two different assay and recovery techniques under such conditions is evaluated. This analysis was undertaken due to the reduced numbers of viable bacteria found in spacecraft assembled in class 100 clean rooms, as was evidenced during the Mariner Venus 1967 sampling program. Data from the capsule mechanical training model assemblies, under the direction of the sterilization assembly development laboratory, were used to form a data base for the statistical analysis. The samples, coupons and swabs, were selected at random and tested by two procedures, one incubating the plates for only aerobic bacteria, while the other incubated for both aerobic and anaerobic bacteria. Conclusions were reached as to the effects of using swabs versus coupons, the difference in recovery percentage between the two types of procedures, and the need for reevaluation of the basic assumptions behind the entire sampling and extrapolation program where the number of organisms per sample is low. A.C.R.

N69-19444 New Mexico Univ., Albuquerque.
CHANGES IN EEG, TEMPERATURE, AND BEHAVIOR AS A FUNCTION OF PROLONGED SLEEP DEPRIVATION
George Vernon Pegram, Jr. (Ph.D. Thesis) 1968 86 p
Avail: Univ. Microfilms HC $4.60/Microfilm $3.00 Order No. 68-11661

An experiment using 6 Macaca mulatta monkeys was conducted to determine the physiological and behavioral changes concomitant with 176 hours of sleep deprivation. The physiological changes were observed by recording EEG and cortical brain

temperature continuously throughout 5 days of baseline, 8 days of deprivation and 8 days of recovery. Primarily, behavioral changes were observed by performance on a delayed matched-to-sample task during which the Se worked for food pellets. The 24 hour cycle based on cortical temperature showed a disruption during deprivation and the return of this 24 hour cycle did not correspond with the EEG or behavioral recovery data. There was some evidence that performance on a delayed matched-to-sample task for food could continue unchanged through 8 days of sleep deprivation. The important behavioral finding was not one of consistent impairment, but one of wide individual tolerance to sleep loss. Dissert. Abstr.

N69-19445 Purdue Univ., Lafayette, Ind.
LATE RESPONSES TO SPEECH STIMULI AS DEMONSTRATED BY ELECTROENCEPHALOGRAPHY UTILIZING A SUMMING COMPUTER TECHNIQUE
Henry Tobin (Ph.D. Thesis) 1968 152 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-12629

A summing computer was employed for an electroencephalographic audiometric (EEA) investigation in an attempt to identify differences in response parameters that were related to the linguistic relevance of speech and speech-like signals. Four normal adults, two male and two female, were tested. Within the restrictions of a limited sample, the following conclusions seemed appropriate: (1) When the close componentry following and small range of latency variability for the signal [kaet] during its time course and for approximately an equal period beyond it are considered, it seems possible that this is an indication of some relationship between linguistic relevance and response parameters. (2) Speech signals, initiated by a voiceless top consonant, can be just as effective in producing an auditorily evoked response as nonlinguistic signals whose initial wave front exhibits a fast rise-time. Differences in the waveform of the evoked responses appear to be related to the acoustic properties of the signals. Dissert. Abstr.

N69-19470 Claremont Mens Coll., Calif. Graduate School.
THE EFFECTS OF CONTROLLED MOVEMENT AND INTENSITY PARAMETERS ON THE PERCEPTION OF AN ENTOPTIC STABILIZED IMAGE
Michael John Seven (Ph.D. Thesis) 1967 190 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 68-10543

An entoptic stabilized image of the retinal blood vessels was produced by a projected spot of light centered on the sclera just beneath the lower edge of the subject's iris. Without temporal change, this image would disappear almost immediately. Temporal change factors were introduced by oscillating this trans-scleral illumination horizontally while the subject fixated the center of an illuminated background. Ten subjects were used in a Lindquist Type VI mixed design, five receiving a high intensity stimulus and five a low-intensity stimulus. Each subject received the 54 combinations of the other four variables in 54 one-minute trials. The dependent variable was a measure of image quality and persistence derived from the subject's continuous evaluation of the image in terms of four objective categories. The data were analyzed using analysis of variance, trend analysis, and Duncan's multiple-range test. Dissert. Abstr.

N69-19487 Pennsylvania Univ., Philadelphia.
THE EFFECTS OF MUSCLE STRETCH ON CALCIUM RELEASE DURING STIMULATION
Joy Antoinette Sopis (Ph.D. Thesis) 1967 119 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-9240

Studies were performed to see if the increased efflux of Ca^{45} was present in a muscle stretched so that there was no overlap of the thick and thin filaments (160% of reference length). Frog semi-tendinosus muscles were soaked 8 to 10 hours in a Ca^{45} Ringer's and then washed out in normal Ringer's for 120 minutes. Muscles were suspended, and tetantically stimulated alternately at reference length and at 160% of reference length. Effluent was collected every 30 seconds, dried and counted. The muscles at reference length showed a three times greater increase in efflux of Ca^{45} with stimulation than the muscles stimulated at 160% of reference length. A 30 second exposure to caffeine (8mM) produced a reversible contracture and the resulting increases in efflux of Ca^{45} at reference length and at 160% of reference length were the same. Caffeine causes contractures by releasing Ca from its intracellular stores in the sarcoplasmic reticulum. Dissert. Abstr.

N69-19523# Joint Publications Research Service, Washington, D. C.
BIOLOGICAL EFFECT OF HIGH-FREQUENCY ULTRASOUND
N. S. Arkhipov et al 4 Feb. 1969 11 p refs Transl. into ENGLISH from Terapevt. Arkh. (Medgiz), v. 40, no. 12, Dec. 1968 p 3–9
(JPRS-47378) Avail: CFSTI

An historical survey of the biophysiological uses and effects of ultrasonic radiation was made. After reviewing the literature, the following conclusions were reached: (1) The effect of ultrasonic waves on tissues is related to a mechanical and vibratory action. (2) A stream of high frequency ultrasonic waves of high intensity, at prolonged exposure, can lead to destruction of exposed tissues and organs. (3) Prolonged exposure of the organism to impulse ultrasonic waves of intermediate intensity for therapeutic and diagnostic purposes did not have an adverse effect on exposed organs and tissues. (4) In low intensity doses ultrasonic waves can stimulate vital processes in tissues and organs and can also elicit reflex action. B.P.

N69-19525# Joint Publications Research Service, Washington, D. C.
SEVERAL MECHANISMS OF REDUCING ORTHOSTATIC TOLERANCE IN EXPERIMENTS WITH SIMULATION OF WEIGHTLESSNESS [NEKOTORYYE MEKHANIZMY SNIZHENIYA ORTOSTATICHESKOY USTOYCHIVOSTI V EKSPERIMENTAKH S IMITATSIYEY NEVESOMOSTI]
I. D. Pestov 13 Feb. 1969 13 p refs Transl. into ENGLISH from Russian paper Presented at 19th Congr. of the Intern. Astronautical Federation, Moscow, Oct. 1968 p 1–13
(JPRS-47452) Avail: CFSTI

In 41 experiments involving water immersion of 18 hours duration (18 test subjects), it was established that compensated and uncompensated forms of orthostatic intolerance (with and without collapse) arise in association with identical water metabolism changes; thus, they may not be distinguished solely by the extent of body dehydration. Orthostatic collapse develops more often in test subjects with instability of autonomic functions and may be prevented by use of pharmacologic stimulants. In a 70 day bed-rest experiment (16 test subjects), a reduction of vascular elasticity in the lower extremities was observed which partially facilitates compensation for the orthostatic disorders. Maintenance of normal elasticity of these vessels with the aid of an occlusion-type, femoral cuff increases the body's reserve volume of blood along with orthostatic disorders. Author

N69-19547# National Research Council of Canada, Ottawa (Ontario)

SHORT NOTE ON THE DISTRIBUTION AND BIOLOGICAL ACTION OF RADIOACTIVE ISOTOPES [BREVE NOTA SULLA DISTRIBUZIONE E AZIONE BIOLOGICA DEGLI ISOTOPI RADIOATTIVI]

F. G. Granone 1968 11 p refs Transl. into ENGLISH from Minerva Radiobiol. Fisioterap. e Radiobiol. (Torino), Italy, v 11, no. 11, 1966 p 604–608 1966

(NRC-TT-1345) Avail: CFSTI

Based on a literature review of the experimental data, a comparative study was made to distinguish certain substantial differences in the distribution of radioactive substances, and in the manner of their elimination by the organism. It is noted: (1) Radionuclides falling within individual groups of the periodic system show common characteristics. (2) In radiobiological research employing radioactive isotopes, great importance is attached to the kinetics of their accumulation in, and elimination from, the organs. Reliable experimental results show that the values of successive accumulations and eliminations change with time. (3) Estimation of the degree of toxicity referred to the effective dose expressed in curies can lead to erroneous deductions concerning the true toxicity of the various nuclides. (4) An important factor in determining the specific nature of radiation sickness is the type of distribution of the radioactive element. M.G.J.

N69-19591# Joint Publications Research Service, Washington, D. C.

PAPERS FROM THE THIRD INTERNATIONAL SYMPOSIUM ON BASIC ENVIRONMENTAL PROBLEMS OF MAN IN SPACE, USSR

6 Feb. 1969 55 p refs Transl. into ENGLISH from various Russian Conf. Papers Held at Geneva, 19–22 Nov. 1968

(JPRS-47398) Avail: CFSTI

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5. SLEEP AND ITS LIMITATIONS IN LONG SPACEFLIGHTS V. P. Zukhar p 36–44 refs (See N69-19596 08-04)

6. PHYSIOLOGICAL REACTIONS TO AND POSSIBLE MEANS OF PROTECTION AGAINST PROLONGED WEIGHTLESSNESS B. B. Yegorov p 45–50 (See N69-19597 08-04)

N69-19592# Joint Publications Research Service, Washington, D. C.

PHYSIOLOGICAL PROBLEMS OF PROLONGED WEIGHTLESSNESS

N. N. Gurovskiy et al *In its* Papers from the Third Intern. Symp. on Basic Environ. Problems of Man in Space, USSR 6 Feb. 1969 p 1–12 (See N69-19591 08-04)

Avail: CFSTI

Experimental techniques and data obtained with the two dogs during the 22-day flight of Cosmos 110 and in subsequent examinations are discussed. The results are compared with those obtained with four dogs in a concurrently conducted ground experiment that completely duplicated the research aboard Cosmos 110. Cardiovascular functions, hemodynamic disturbances resulting from weightlessness, and the accompanying hypokinesia were investigated. The analysis of the data shows that a comparatively long stay aboard a spacecraft results in qualitatively new and pronounced changes in highly developed animals. Among the significant changes were the loss of 30% of body weight and disruption of the ionic equilibrium, apparently related to loss of water by the tissues. K.W.

N69-19593# Joint Publications Research Service, Washington, D. C.

BODY REACTIONS TO EXTREME FACTORS

V. V. Antipov et al *In its* Papers from the Third Intern. Symp. on Basic Environ. Problems of Man in Space, USSR 6 Feb. 1969 p 13–21 refs (See N69-19591 08-04)

Avail: CFSTI

The effects of such dynamic space flight stresses as vibration, acceleration, and, to a lesser extent, weightlessness, when combined with radiation effects were studied on animals. Besides being of theoretical interest, the studies also had two applied aspects: determination of the maximum permissible levels of radiation for spacecraft crews, and determination of effective methods of providing protection against radiation injury during space flight. The general biological patterns of both the isolated and the combined effects of extreme factors on living organisms were analyzed. Experiments were performed on organisms with different levels of phylogenetic development, using a variety of methods. Mice and guinea pigs were used to determine tolerance to acceleration, cardiac rate after administration of antiradiation drugs, and changes in ceruloplasmin activity. The antiradiation drugs cystamine, AET, serotonin, and 5-methoxytryptamine (5-MOT) were tested. K.W.

N69-19594# Joint Publications Research Service, Washington, D. C.

SOME COMPENSATORY REACTIONS IN PROLONGED WEIGHTLESSNESS

J. Walawski *In its* Papers from the Third Intern. Symp. on Basic Environ. Problems of Man in Space, USSR 6 Feb. 1969 p 22–27 (See N69-19591 08-04)

Avail: CFSTI

The current stand of knowledge regarding the effects of weightlessness on the circulatory, respiratory, blood, digestive, and nervous systems and on the metabolism is reviewed. The general findings of several investigators are discussed as well as specific experiments on vascular reactions to intravenous injections of neurohormones during simulated weightlessness by immersion. Problems in the various methods of simulating weightlessness are briefly discussed. The role of the indirect or neurological factor, which originates mostly in emotional phenomena, on reactivity changes under conditions of weightlessness is considered. K.W.

N69-19595# Joint Publications Research Service, Washington, D. C.

REACTIVITY IN LONG SPACEFLIGHTS

P. V. Vasilyev *In its* Papers from the Third Intern. Symp. on Basic Environ. Problems of Man in Space, USSR 6 Feb. 1969 p 28–35 refs (See N69-19591 08-04)

Avail: CFSTI

Weightlessness and hypodynamia have been found to produce changes in the functioning of the circulatory, respiratory, excretory, and analyzer systems and in various metabolic processes. Functional reorganization of these systems must inevitably result in changes in general reactivity closely related to body resistance. The literature and findings are analyzed which indicate that weightlessness and hypodynamia reduce orthostatic and vestibular tolerance, increase

susceptibility to infection, lower resistance to acceleration and physical exercise, and alter reactivity to drugs. These observations demonstrate the need for a thorough study of the various effects of weightlessness on the human body, especially those of weightlessness combined with other factors during long spaceflights. Author

N69-19596# Joint Publications Research Service, Washington, D. C.
SLEEP AND ITS LIMITATIONS IN LONG SPACEFLIGHTS
V. P. Zukhar *In its* Papers from the Third Intern. Symp. on Basic Environ. Problems of Man in Space, USSR 6 Feb. 1969 p 36-44 refs (See N69-19591 08-04)
Avail: CFSTI

The main factors that may alter the sleep patterns of man and influence the duration and phase correlation of sleep are briefly discussed, including: (1) weightlessness and related changes in the nature of the information arriving from the proprioceptive and exteroceptive receptors and vestibular apparatus; (2) hypokinesia and hypodynamia, which are severe complications of weightlessness and confinement to the limited living space; (3) nervous and emotional strain caused by the dangers, responsibilities, and unusual nature of spaceflight; (4) limited range of activity, meager information, and monotonous surroundings; and (5) changes in the circadian rhythms, light, air temperature, and noise background. Data are presented on an investigation of sleep under conditions simulating space flight. Some methods for physiological control of sleep patterns are suggested. The comparative effectiveness of various ways of organizing the sleep and rest of astronauts during long spaceflights is evaluated. Author

N69-19597# Joint Publications Research Service, Washington, D. C.
PHYSIOLOGICAL REACTIONS TO AND POSSIBLE MEANS OF PROTECTION AGAINST PROLONGED WEIGHTLESSNESS
B. B. Yegorov *In its* Papers from the Third Intern. Symp. on Basic Environ. Problems of Man in Space, USSR 6 Feb. 1969 p 45-50 (See N69-19591 08-04)
Avail: CFSTI

Ground experiments were conducted in which stimulation of the vestibular apparatus by calorization and polarization served as a model. There was a distinct reaction by the autonomic nervous system: lowering of arterial pressure and slowing of the cardiac rate. Electrical stimulation was used to normalize the flow of impulses from the proprioceptors. The thigh muscles and prelum abdominale were stimulated by electrical impulses at a frequency of 100 Hz. The hypothesis that the skeletal musculature after electrical stimulation becomes the source of a powerful flow of afferent impulses and a central formation of the nervous system was confirmed by the results of the experiments. Attention was also paid to bony tissues in an effort to find ways of protecting the weightbearing locomotor apparatus. Studies on calcium metabolism involving the use of isotopes were undertaken on rats in order to elucidate some of the pathogenic mechanisms governing decalcification. Also briefly described are studies concerned with the possibility of increasing body resistance to accelerations in the final stage of space flight. A 15-minute orthostatic load served here as a functional test. K.W.

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N69-18681 Wisconsin Univ., Madison.
A CYBERNETIC ANALYSIS OF VISUAL FEEDBACK DELAY AND INTERMITTENCY IN HUMAN TRACKING PERFORMANCE
Henry Shang-Ren Kao (Ph.D. Thesis) 1968 155 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-7107

This research was conducted to test a real-time feedback theory of tracking and to evaluate the traditional stimulus-response conditioning concept of optimal intermittency in human motor response regulation. The research assumptions stated that temporal factors of delay and intermittency, contrary to traditional view, would interfere with tracking performance at variable degrees. It was also assumed that it would not be possible to establish optimal conditions of intermittency in stimulus regulation other than continuous control. Three studies were conducted. The first study compared the effects of feedback delay and intermittency on tracking under identical magnitudes as separate univariate factors. The second study concentrated on the multivariate interaction of both delay and intermittency in tracking. The third study examined the conditions of visual feedback persistence and non-persistence in tracking in relation to delay and intermittency. Dissert. Abstr.

N69-18755*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Biotechnology Organization.
DEVELOPMENT AND DESIGN OF AN ISOTOPE-HEATED CATALYTIC OXIDIZER TRACE CONTAMINANT CONTROL SYSTEM
Thomas M. Olcott 28 Feb. 1969 178 p refs
(Contract NAS1-7433)
(NASA-CR-66739) Avail: CFSTI CSCL 06K

The contaminant load and data from recent manned simulator tests and outgassing and degradation studies of materials were reviewed to develop a contaminant load for the pre- and post-sorbent beds. The contaminants selected were those contaminants known to be potentially poisonous to catalyst activity and those contaminants that might decompose and be oxidized to harmful products. The detailed design of the isotope heated catalytic oxidizer system included a stress analysis of the main structure and a review of the thermal characteristics. Following this, detailed design drawings for the entire system were prepared. The resistively heated unit is, insofar as possible, an exact duplicate of the radioisotope – fueled unit except that the thermal power is obtained from a resistively heated element located in the fuel cavity, and heater element and thermocouple leads pass through the heat exchanger core. Author

N69-19083# Lockheed Missiles and Space Co., Sunnyvale, Calif. Research and Development Div.
DESIGN STUDY OF INTEGRATED LIFE SUPPORT SYSTEM FOR AEROSPACE APPLICATION UTILIZING RADIOISOTOPES FOR THERMAL ENERGY Final Report
R. V. Elms, Jr. 31 Mar. 1968 209 p refs
(Contract AT(04-3)-739)
(LMSC-680679) Avail: CFSTI

The large amounts of thermal energy required to support crews for space missions beyond 180 days can be supplied by radioisotope thermal energy (RITE) sources. Life support system (LSS) components and techniques to identify an integrated acrospace life support system providing the highest reliable usable payload with the lowest possible launch weight are evaluated. RITE was also evaluated to determine the optimum energy source. The evaluations of life support system components, candidate isotopes and heating systems resulted in a conceptual design of an integrated life support system and the selection of an LSS component for detail design. The conceptual system design, utilizes an individual RITE source in the catalytic oxidizer and in the combined incinerator/urine vapor pyrolysis unit. A third RITE source heats a central heat transfer fluid loop (375°F) to supply energy to the remaining LSS

components. A detailed design of the waste incinerator/urine vapor pyrolysis unit/RITE source was performed such that a functional-proof-of-principle component can be fabricated. Author (NSA)

N69-19144# Environmental Sciences Services Administration, Atlantic City, N. J. Systems Development Office.
EVALUATION OF MULTI-TRANSMISSOMETER SYSTEMS Final Report
Ernest E. Schlatter and Matthew Lefkowitz Aug. 1968 207 p refs
(SRDS-RD-68-49) Avail: Issuing Activity

A test program was conducted to evaluate multi-transmissometer systems. These consisted primarily of instruments at touchdown, midpoint, and rollout locations on a runway at five airfields distributed across the U.S. continent in differing climatic regimes. Primary objective of the program was to determine if a need exists for three transmissometer systems per runway under a variety of weather conditions. The conclusions were affirmative, due primarily to the fact that differences in runway visual range as large as 2000 feet or greater do occur during low visual range conditions. These large variations might go undetected without a midpoint runway visual range measurement. Author

N69-19164# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
PROBLEMS OF INFORMATION TRANSFER IN THE MODERN JET COCKPIT Final Report
W. C. Schultz Dec. 1968 24 p refs
(CAL-IH-2235-B-1) Avail: Issuing Activity

If the time to act on signals is to be maximized, an objective that is assumed to be desirable, then more emphasis must be placed on improving the chances of acting quickly and properly on the signals that are available. Four facets of the problem of improving information transfer in the cockpit are considered: (1) discussion of the gaps which exist in the transfer of information to the pilot of a jet aircraft (e.g., the pilot not having sufficient information to quickly identify certain potentially dangerous flight conditions); (2) a taxonomy of flight safety research; (3) a discussion of how flight safety research might be correlated with careful regard for, and consideration of the above, taxonomy; and (4) a discussion of steps now being taken in a planned experimental approach towards improvement of information transfer in the cockpit. Author

N69-19360# Joint Publications Research Service, Washington, D. C.
AUTOMATION TO INCREASE THE PRODUCTIVITY OF LABOR
A. Latov *In its* Cybernetics and Regulation Theory, USSR 13 Feb. 1969 p 8-12 Transl. into ENGLISH from Ekon. Gazeta (Moscow), no. 52, Dec. 1968 p 36 (See N69-19358 08-34)
Avail: CFSTI

The technological impact of automation on society is briefly assessed. Scientific and engineering problems concerned with the development of automation are reviewed and included: optimal control methods constructing adaptive and self-adjusting systems and development of principles on constructing automatic machines for engineering design operations. B.P.

N69-19384# United Kingdom Atomic Energy Authority, Harwell (England).
TYPE "A" PACKAGING FOR LIQUIDS AND GASES
F. E. Dixon, F. K. Olley, and L. R. Cohen Aug. 1968 60 p refs
(AERE-R-5701) Avail: CFSTI; UK 20s

A proposal is made for amendment of the Additional Tests specified in I-3 Annex IV, and of design requirements in II-1.6 Annex II, I.A.E.A. Safety Series No. 6 (1967 edition). The median accident is given in Safety Series No. 7 as the basis for the amount of contents allowed in a Type A package. A Swedish experimental team in an interim report attempted to specify a median accident, and this led to the series of tests described. The conclusion appears to be that many Type A packages are capable of successfully withstanding the mechanical test prescribed in the regulations for Type B packaging and that if accidents more severe than the Type B tests are excluded there is no universal median accident. The series of tests suggests that the parameters in I-3 Annex IV and II-1.6 Annex II of the IAEA regulations are inappropriate in light of present experience, and an alternative approach to their respective requirements is suggested. Author (NSA)

N69-19405* TRW Systems, Redondo Beach, Calif.
THERMAL PROPERTY MEASUREMENTS OF MANNED SPACECRAFT CENTER SPACESUIT MATERIALS
F. J. Turnbow 17 Jan. 1969 8 p refs
(Contract NAS9-3670)
(NASA-CR-99535; TRW-69-8526.16w-03) Avail: CFSTI CSCL 06K

The thermophysical properties of polysulfane have been measured. The properties of interest were: (a) solar reflectance; (b) solar transmittance; and (c) normal emittance. Measurements of the subject properties were taken both on the coated and uncoated surfaces. Results of the solar reflectance and transmittance measurements on the polysulfane (uncoated) side of the sample were previously reported. They are included herewith as an aide to data evaluation. Author

N69-19482 Massachusetts Univ., Amherst.
THE EFFECT OF ADVANCE CUEING ON THE DETECTION OF TARGETS IN A VISUAL SEARCH TASK
Joseph Francis Hearns (Ph.D. Thesis) 1968 15 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 68-9176

The purpose of the present experiment was to overcome the limitations of inequitable visual search and the interacting effects of short- and long-term memory found in the target detection experiments of Hearns and Moss (in preparation) and Teichner and associates. It was hypothesized that these problems could be overcome by the dual processes of advanced cueing and target color coding. The data of the total number of targets correctly reported, the percentage of targets correctly reported, and total point accumulations indicated that target color coding significantly facilitated search under the most difficult detection conditions and completely eliminated the interacting effects of short- and long-term memory. The effect of advance cueing was negated by its short exposure time. Two models are hypothesized to account for the detection and report of targets in this task. Dissert. Abstr.

N69-19483 Brandeis Univ., Waltham, Mass.
SOME INVESTIGATIONS OF THE AUDIOGYRAL ILLUSION
Gene Lester (Ph.D. Thesis) 1968 167 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-9938

This dissertation describes a series of investigation of the audiogyral illusion, a phenomenon which occurs when a S is subjected to angular acceleration around his vertical axis. When the illusion occurs, a sound which is maintaining a constant position with regard to S appears to S as if it were displaced in a systematic fashion. During angular acceleration, the sound appears

displaced in the direction counter to rotation. Our investigations sought to give a clear demonstration of the illusion. A second intention of the investigations was to test three hypotheses about the basis of the illusion. Dissert. Abstr.

N69-19573 National Lending Library for Science and Technology, Boston Spa (England).
CLOSED-CIRCUIT OXYGEN BREATHING APPARATUS. REQUIREMENTS AND TECHNICAL TESTS [APARATY TLENOWE REGENERACYJNE Z TLENEM SPREZONYM. WYMAGANIA I BADANIA TECHNICZNE]
Nov. 1968 32 p Transl. into ENGLISH of Polish report PN-65/Z-04077
(NLL-SMRE-Trans-5634-(8313.6)) Avail: Natl. Lenging Library, Boston Spa, Engl.

Standard requirements and technical tests for a self sustaining oxygen breathing apparatus using compressed oxygen cylinders, recommended by the Polish Standardization Committee, are presented. Technical requirements for each component, applications of the equipment for general, rescue, or escape work; packing and transport of the apparatus; and a description of the performance tests which should be conducted are described. In addition, physiological tests using human subjects and methods of assessing the test results are also treated. A.C.R.

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N69-18453 Cornell Univ., Ithaca, N. Y.
IMPURITY EFFECTS ON THE IONIZATION STATES OF F-AGGREGATE COLOR CENTERS IN SODIUM FLUORIDE
Ashoka Chandra (Ph.D. Thesis) 1968 214 p
Avail: Univ. Microfilms: HC $4.70/Microfilm $3.00 Order No. 68-9876

In order to study the role of hydroxide and peroxide impurities on color center properties in sodium fluoride, several crystals were grown with the Kyropoulous technique. In addition to undoped samples, several crystals doped with varying amounts of sodium hydroxide and sodium peroxide were grown. The optical state of hydroxide and oxygen impurities in the doped samples was studied. The oxygen impurities in peroxide doped samples are considered. The optical absorption in peroxide doped samples consists primarily of three bands at 275 mμ, 235 mμ, and 195 mμ respectively. On the basis of photochemical evidence these bands have been assigned to O^-, O^0, and O^{--} respectively. Upon irradiation of the samples with X-rays at room temperature, significant differences are observed. The production of F centers is determined almost entirely by impurities with a small contribution due to intrinsic processes. The large coloration in hydroxide and peroxide doped samples are explained on the basis of photochemical reactions involving impurities which act as sources of anion vacancies and electrons. Dissert. Abstr.

N69-18464 Washington Univ., Seattle.
NUCLEAR RELAXATION BY SPIN DIFFUSION IN RARE EARTH DOPED CALCIUM FLUORIDE
Eiichi Fukushima (Ph.D. Thesis) 1967 84 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-9284

A theoretical and an experimental investigation of the nuclear spin-lattice relaxation process by spin diffusion to paramagnetic ions in the more general case of non-negligible concentration of ions. It is noted that the conditions under which the usual solution of the spin diffusion equation is valid can be violated quite easily even in samples which are doped with ions in relative concentrations as small as 10^{-4}. A modified expression for the nuclear spin-lattice relaxation rate is obtained in the diffusion limited case by graphical methods. Pulse nuclear magnetic resonance experiments were performed on several rare earth doped CaF_2 crystals at frequencies between 5.5 and 20 Mc/sec and at temperatures between 150 and 500°K. Much of the data was obtained from a .01% Gd^{3+} doped sample for which it was found that over the temperature range $280 \leq T \leq 450$°K the best fit is given by $1/T_1 \propto C^{1/2}$ and $\tau \propto \omega^{-1/4} T^{-6}$ where τ is the paramagnetic spin-lattice relaxation time of the ion, and T_1 is the nuclear spin-lattice relaxation time. Dissert. Abstr.

N69-18537 Pennsylvania State Univ., University Park.
MASS SPECTROMETRIC ANALYSIS OF FIELD EVAPORATION
Douglas Fred Barofsky (Ph.D. Thesis) 1967 78 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-8662

A first-order focusing mass spectrometer was built using a field ion microscope tip assembly as an ion source. The instrument is capable of detecting field evaporated ions under the normal, low temperature, operating conditions of a field ion microscope. At liquid hydrogen temperature field evaporation of Be, Fe, Cu, and Zn in a background vacuum of approximately 10^{-7} torr yields Be^{++}, Fe^{++}, Cu^{+}, Cu^{++}, Zn^{+}, and Zn^{++} respectively. At liquid nitrogen temperature nickel field evaporates as Ni^{++}. This is the first time low temperature field evaporation products have been detected and identified. The charges of the detected ions of these metals are essentially those predicted from the image force theory of field evaporation. In the presence of hydrogen nearly all of the metals exhibited hydride ions, and their identification was confirmed by producing the corresponding deuteride ions. Dissert. Abstr.

N69-18538 Pennsylvania State Univ., University Park.
CRYSTAL CHEMISTRY AND PHYSICAL PROPERTIES OF SOME SULFOSPINELS AND THEIR POLYMORPHS
Richard Ernest Tressler (Ph.D. Thesis) 1967 135 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-8754

The crystal chemistry of sulfospinels was investigated by making an exploration of the structure field. By plotting the radius of the B^{3+} ion versus the radius of the A^{2+} ion for AB_2S_4 compounds from literature sources and synthesis work, the structure field was delineated for simple sulfospinels. With large B^{3+} ions (0.85–0.90 Å) there is considerable overlap of the spinel and α-CaY_2S_4 type structure fields. For large B^{3+} and A^{2+} ions the spinel type, α-CaY_2S_4 type, and TH_3P_4 type structure fields overlap. With smaller B^{3+} ions (< .60 Å), the defect zincblende, defect wurtzite, or a similar rhombohedral structure overlap with the spinel structure field. The entire structure field is shifted to slightly larger cations for sulfospinels as compared to oxide spinels, and the addition of the smaller rare earth ions in the sulfospinels is especially noteworthy. Dissert. Abstr.

N69-18542 California Univ., Berkeley.
RADIO FREQUENCY STARK SPECTRA OF RbF, RbCl, CsF, CsCl, AND NaI
Francis John Lovas (Ph.D. Thesis) 1967 91 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-10362

The molecular beam electric resonance method was used to measure the radio frequency Stark spectra of ^{85}RbF, ^{87}RbF, $^{85}Rb^{35}Cl$, CsF, $Cs^{35}Cl$, and NaI. Weak field measurements were made on RbF to obtain accurate hyperfine structure constants. Intermediate to strong field measurements were made on all the above molecules to obtain dipole moment values for the three lowest vibrational states of the J = 1 or 2 rotational state. Work on a polarizable ion model of the alkali halides which computes dipole moments, the molecular dissociation energy and the second coefficient of the Dunham expansion of the potential energy is also presented. Good agreement with experimental values is obtained.
Dissert. Abstr.

N69-18554 Florida Univ., Gainesville.
EXPERIMENTAL INVESTIGATION OF NEGATIVE ION COLLISIONS: ELECTRON DETACHMENT AND ION-MOLECULE REACTIONS
John David Martin (Ph.D. Thesis) 1967 83 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-13019

This dissertation consists of experimental studies of two important types of negative ion-molecule collision processes: direct electron detachment and ion-molecule reaction. Total cross-sections for the collisional detachment processes, $OH^- + HE \rightarrow OH + HE + e^-$, and $O^-_2 + He \rightarrow O_2 + He + e^-$, have been measured in ion beam-gas scattering experiments, at primary ion energies from 400 eV down to a few eV. From phase space considerations, which may be expected to apply in the region near threshold, it can be shown that the total cross-section σ depends on the center-of-mass collision energy E_{CM} according to: $\sigma^{1/2} \propto (E_{CM} + Q)$, where Q is the energy defect of the detachment process. Both collision systems were studied in detail in the threshold region, and both were found to follow the predicted, $\sigma^{1/2} \propto (E_{CM} + Q)$ behavior closely.
Dissert. Abstr.

N69-18555 North Carolina State Coll., Raleigh.
NUCLEAR MAGNETIC DOUBLE RESONANCE OF COMPLEX SPIN SYSTEMS
Robert Henry Wakefield, Jr. (Ph.D. Thesis) 1968 162 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-13480

High resolution nuclear magnetic double resonance techniques have been used in conjunction with density matrix calculations to determine the principal relaxation mechanism in the two-spin system of dehydro α-lapacone and the three-spin system of dipotassium malate. Dehydro α-lapacone was found to relax by predominantly correlated random fields, while the mechanism for dipotassium malate was uncorrelated random fields. The development of the Redfield equation without the secular approximation is given, as is the solution of the density matrix equation of motion for the spin system under double resonance conditions. Experimental double resonance spectra are compared with the theoretical spectra calculated with different relaxation mechanisms to determine which relaxation process is operative in the system. The relative signs of the spin coupling constants were determined by spin "tickling" methods in the case of the three-spin system.
Dissert. Abstr.

N69-18556 University of Southern Calif., Los Angeles.
VIBRATIONAL SPECTRA AND INTERMOLECULAR FORCES IN CRYSTALLINE BENZENE AND NAPHTHALENE
Nathan Harold Rich (Ph.D. Thesis) 1968 82 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-12055

Frequencies and polarizations for vibrational transitions for the internal modes of crystalline benzene and naphthalene have been calculated using forces between non-bonded atoms as a perturbation on the solutions for isolated molecules. Potentials of the form $V = -AR^{-6} + B \exp(-CR)$ were used. R is the interatomic distance; A, B, and C depend on whether a contact is between two hydrogen atoms, two carbon atoms, or a carbon-hydrogen pair. For benzene only the repulsive part of the potential between hydrogen atoms was used. The parameters were taken from a calculation by de Boer for the interaction of two hydrogen molecules. Calculations for naphthalene were done using the same limited model, and also others including carbon-hydrogen and carbon-carbon forces. The computations were compared with published spectra of benzene. The quality of the results depends on the parameters of the model potentials.
Dissert. Abstr.

N69-18557 Purdue Univ., Lafayette, Ind.
ACOUSTOELECTRIC DOMAIN EFFECTS IN III-V COMPOUNDS AND THEIR RELATION TO CURRENT INSTABILITIES
Phillip Oscar Slivа (Ph.D. Thesis) 1968 244 p
Avail: Univ. Microfilms: HC $11.05/Microfilm $3.15 Order No. 68-12620

The present work deals with current instabilities observed in III-V compounds subjected to electric fields above a critical value. The instabilities correspond to periodic increases in the sample resistance which are observed to be related to the presence of restricted regions (domains) of excess resistance which are "generated" or "nucleated" at favored sites in the crystal and which propagate through the crystal with a velocity equal to that of the appropriate piezoelectrically-active sound wave in the material. A series of diagnostic measurements of the electrical properties of the sample as a whole establish the sonic origin of the excess resistance. Probe measurements (both electrical and optical) relate the shape of each oscillation to the generation, growth, and one-way transit of one of these domains through the crystal.
Dissert. Abstr.

N69-18558 Rensselaer Polytechnic Inst., Troy, N. Y.
THE EFFECT OF SILVER ON DIFFUSION IN ZINC
Carmelo James Santoro (Ph.D. Thesis) 1968 107 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-13525

The diffusivities of Zn^{65} and Ag^{110} parallel and perpendicular to the hexagonal axis have been measured in mono-crystalline zinc doped with up to 1.4 atomic percent silver. The standard radio-tracer sectioning technique was used over the temperature range 320°-417°C. An enhancement of both the solvent and solute diffusion occurs at the same activation energies as for self-diffusion in the pure zinc matrix. The concentration dependence is well fitted by the exponential relation $D(c) = D(o) \exp(bc)$ where c is the solute mole fraction. This temperature independent enhancement is consistent with the observations of self-diffusion in zinc with copper and aluminum doping as well as other results in doped multivalent metals. A qualitative explanation of the augmented self-diffusion is advanced on the basis of the oscillating potential model of an impurity in a metallic lattice. This model appears to account for the enhancement as well as its anisotropy.
Dissert. Abstr.

N69-18572 Case Western Reserve Univ., Cleveland, Ohio.
THE PRESSURE AND TEMPERATURE DERIVATIVES OF THE ELASTIC CONSTANTS OF BaF_2 AND CaF_2
Chuen Wong (Ph.D. Thesis) 1967 88 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-10192

The elastic constants and their pressure and temperature derivatives were measured by the ultrasonic pulse-echo technique for CaF_2 and BaF_2 at 195°K and 298°K. The elastic constants and the pressure derivatives were analyzed in terms of a dipole

shell model due to Axe. The Gruneisen parameter in the low temperature limit was calculated and found to compare favorably with the Gruneisen parameter determined from thermodynamic data. The explicit volume dependencies of the normal mode frequencies for the non-dispersive acoustic modes were calculated. The ultrasonic equation of state is determined and compared with Bridgman's compression data. Dissert. Abstr.

N69-18574 University of Southern Calif., Los Angeles.
A THEORETICAL ANALYSIS OF THE RARE GAS AUTOIONIZATION BETWEEN THE SUP 2 P SUB 3/2 AND SUP 2 P SUB 1/2 SERIES LIMITS, WITH APPLICATIONS TO Ar
Antonio Juan Mendez (Ph.D. Thesis) 1968 132 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-12049

Experimental data are shown to illustrate the fact that the absorption cross sections of the rare gases Ne, Ar, Kr, and Xe have the same generic form in the energy region between their respective $p^5(^2P_{3/2})$ and $p^5(^2P_{1/2})$ series limits. The absorption cross sections are all seen to be severely altered by autoionization. The autoionization is ascribed to a configuration mixing among the (odd parity, unity total angular momentum) configurations $p^5(^2P_{3/2})ns_{1/2}$, $p^5(^2P_{3/2})nd_{3/2}$, $p^5(^2P_{3/2})nd_{5/2}$, $p^5(^2P_{1/2})ns_{1/2}$, $p^5(^2P_{1/2})nd_{3/2}$. The configuration mixing is due to the electron-electron interaction, and the interaction matrix is presented. Then arguments are given which show that in the energy region of interest the s- and d-state mixing can be neglected, so that the interaction matrix can be reduced in complexity. Dissert. Abstr.

N69-18576 Purdue Univ., Lafayette, Ind.
MOESSBAUER, X-RAY, AND CHEMICAL STUDIES OF COBALTOUS OXIDE
Hang Nam Ok (Ph.D. Thesis) 1968 173 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-12597

The existence of two forms of cobaltous oxide CoO(I) and CoO(II), has been established by Mössbauer, X-ray, and chemical techniques. CoO(I) has the NaCl structure as determined by a well resolved powder X-ray pattern. Its density is measured to be 6.4 g/cm^3 from both X-ray and direct macroscopic experiments. Fe^{57} Mössbauer lines in CoO(I), doped with Co^{57}, show only Fe^{2+} when determined by either the isomer shift or the hyperfine splitting below the Néel temperature. We find a Néel temperature of 288°K, which is 3°K less than the value reported by earlier workers. CoO(II) has a Néel temperature of 270°K ± 10°K, slightly less than CoO(I), and an effective Mössbauer characteristic temperature of 320°K, substantially less than the 510°K found for CoO(I). The results of studies of thermally activated transformation of II → I and pressure and quenching experiments are given. Dissert. Abstr.

N69-18677 California Univ., Berkeley.
ELECTRON SPIN RESONANCE STUDIES OF RADICALS PRODUCED BY ELECTROLYSIS
Carolyn L. Talcott (Ph.D. Thesis) 1967 128 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-10423

The ESR spectra of the radical anions of pyridine, pyrimidine, and pyrazine in liquid ammonia were measured. The coupling constants obtained from these spectra allowed values of the quantities $Q_N{}^N$, $Q_{CN}{}^N$, and $Q_{CH}{}^H$ to be determined without relying on calculated spin densities. The values found are: $Q_N{}^N = +27.3$ gauss, $Q_{CN}{}^N = 1.7$ gauss, and $Q_{CH}{}^H = -24.5$ gauss. Theoretical values for the parameters $Q_N{}^N$(pyridine, pyridine N-oxide, nitrosobenzene, and nitrobenzene), $Q_{CN}{}^N$, and $Q_{ON}{}^N$ were calculated using configuration interaction in an MO framework. The ESR spectra of several substituted pyridine radical anions in liquid ammonia are reported including: 4-picoline, 3,5-lutidine, pyridine N-oxide, 4-picoline N-oxide, and 2,6-lutidine N-oxide. A series of McLachlan type spin density calculations were carried out in order to determine values of the variable parameters appropriate for the various N-heterocyclic radical anions. Dissert. Abstr.

N69-18678 Princeton Univ., N. J.
DISCHARGE POLARIZATION OF HE-3 GAS
Gene Heath McCall (Ph.D. Thesis) 1968 113 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order 68-9686

Substantial nuclear polarization effects have been produced by maintaining a discharge in a He^3 sample when placed in a magnetic field. Although it may be thought that the effect of a discharge would be to increase the electron temperature and bring about relaxation to a small Boltzmann population difference, it was found that enhancements of nuclear polarization of greater than 2000 could be obtained. Also, a study of the magnetic field dependence of the effect has shown that it is possible to have a negative spin temperature, or inverted population in certain ranges of the magnetic field. The maximum polarization obtained was .06 percent, which corresponds to an enhancement of 2200 at 1 kilogauss. The nuclear polarization was measured by nuclear magnetic resonance. Dissert. Abstr.

N69-18689 Cornell Univ., Ithaca, N. Y.
A NUCLEAR MAGNETIC RESONANCE STUDY OF VANADIUM CHROMIUM HYDRIDE
David Alan Rohy (Ph.D. Thesis) 1968 119 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-9893

Previous experiments on vanadium in vanadium chromium alloys and in vanadium hydrides had striking similarities which suggested that hydrogen exists in the transition metal hydride as an interstitial positive ion that has contributed its electron to the conduction band. With this assumption and a rigid band model, it can be seen that the alloying of hydrogen with a transition metal should affect the conduction band as if another metal with one extra electron per atom were alloyed with the original metal. Since vanadium chromium alloys with up to 60% chromium lie on a steep section of the electron density of states curve (as determined by electron specific heat experiments) the Knight shift, spin lattice relaxation time, T_1, and electron specific heat, which are directly affected by the electron density of states at the Fermi level, should reflect a change in the electron density of states upon hydriding. Ternary alloys $V_{(1-x)}\ Cr_xH_y$ were prepared. The value of the ratio (e/a), the number of conduction electrons per transition metal ion, is determined for each $V_{(1-x)}\ Cr_xH_y$ alloys as $(e/a) = 5(1-x) + 6x + y$. In the range $5.0 < (e/a) < 5.6$ the vanadium Knight shift and relaxation rate $(1/T_1)$ were found to be independent of the relative proportions of chromium and hydrogen, depending only on the (e/a) ratio. The electron specific heat of two metal hydrides was also measured. Dissert. Abstr.

N69-18718 California Univ., Riverside.
NUCLEAR MAGNETIC RESONANCE IN DILUTE LEAD AND TIN ALLOYS OF INDIUM
Wallace Thad Anderson, Jr. (Ph.D. Thesis) 1967 89 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 68-9749

Nuclear magnetic resonance has been observed in the alloys of indium with lead and tin at 4.2°K. Measurements have been made of the isotropic Knight shift, anisotropic Knight shift, and the quadrupole coupling of the In^{115} nucleus as a function of the solute concentration to 5.80 at. % Pb and to 9.70 at. % Sn. The isotropic Knight shift of Sn^{119} has been measured in the range 2.90 to 9.70 at. % Sn in the In–Sn alloys. A comparison of these results with the scattering theories of Blandin and Daniel and of

Kohn and Vosko is made. Qualitative agreement is found in the In^{115} isotropic Knight shift from 2 to 6 at. % while below 2 at. % the Knight shift is found to dip abruptly showing no agreement with theory. Assuming the total electric field gradient to be negative a good fit is made to the observed quadrupole coupling with Sternheimer's calculated value for the antishielding, $1 - \gamma_\infty = 25.9$. Dissert. Abstr.

N69-18732 Princeton Univ., N. J.
A STUDY OF SOME OF THE ELECTRICAL PROPERTIES OF ZINC OXIDE
William Andrew Keenan (Ph.D. Thesis) 1968 93 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-9683

Photoemission is used as a probe to locate the Fermi level of a metal in intimate contact with ZnO, with respect to the ZnO valence and conduction band. The photoemission thresholds for electrons from silver and gold into the conduction band of ZnO were 1.16 Ev and 1.65 eV, respectively; and for holes into the valence band of ZnO were 2.22 eV and 1.67 eV, respectively. Optical density and filter experiments rule out ZnO bulk optical absorption as the cause of the currents measured in response to light of energy less than 2.8 eV. Some of the effects of ambient gases on the steady state photocurrent, photocurrent decay and steady state dark current were measured. Similar experiments were attempted with both single crystals and thin film samples of MgO without success. Dissert. Abstr.

N69-18751# Royal Aircraft Establishment, Farnborough (England).
THE COLORIMETRIC DETERMINATION OF GOLD
A. J. Christopher Jun. 1968 13 p refs
(RAE-TR-68152) Avail: CFSTI

The spectrophotometric determination of gold with 4,4'-bis(dimethyl-amino) thiobenzophenone (TMK) has been adapted for routine use in the range 0-50 μg of gold. Composite reagent solutions incorporating TMK, acetic acid, sodium acetate and either ethanol or n-butanol are convenient, and stable if protected from light. The butanolic reagent gives results with 95% confidence limits of about ± 1.5 μg of gold for a single determination of absorbance. Procedures using either ethanolic or butanolic reagents are applicable to the determination of up to 50 μg of palladium, silver or mercury. Author (ESRO)

N69-18825# Commissariat à l'Energie Atomique, Fontenay-aux Roses (France). Centre d'Etudes Nucléaires.
SURVEY OF THE CHEMICAL DIFFUSION AT INFINITE DILUTION IN THE NICKEL-PLUTONIUM AND ALUMINUM-URANIUM SYSTEMS [CONTRIBUTION A L'ETUDE DE L'HETERODIFFUSION DILUTION INFINIE: SYSTEMES NICKEL-PLUTONIUM ET ALUMINIUM-URANIUM]
Jean-Jack Blechet (Ph.D Thesis) Sep. 1968 88 p refs In FRENCH; ENGLISH summary
(CEA-R-3577) Avail: CFSTI

The solubility and the chemical diffusion coefficients at infinite dilution of plutonium in nickel have been determined by autoradiography in polyphased system by the welded couples method. Solubility varies from 40 to 80.10 (atomic concentration) and diffusion coefficients follow an Arrhenius law. The measurement of the diffusion of uranium in aluminium was carried out by fissiography using the thin layer method. The frequency factor lies between 0.01 and 3.1 cm^2/s and the activation energy lies between 24×10^3 and 34×10^3 cal/mole. Author (ESRO)

N69-18902 Washington Univ., Seattle.
A NUCLEAR MAGNETIC RESONANCE STUDY $NH_4H_2PO_4$
Jon Fredrick Soest (Ph.D. Thesis) 1967 159 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-9331

An extensive survey of the properties of nuclear magnetic resonance in ordinary and deuterated $NH_4H_2PO_4$ has been made. Observations were made of line width and shape, quadrupole splittings, and spin-lattice relaxation at temperatures above and below the antiferroelectric transition. In the ordinary crystal, unusual proton line width and shape characteristics are attributed to ammonium proton dipolar fields of large magnitude which conceal any effects of the antiferroelectric transition. Changes in line width and shape are shown to be entirely a result of the ammonium rotation. Proton T_1 is also dominated by the rotation, and results of such measurements reflect only the dynamics of the ammonium group. Similarly, observations in the deuterated crystal show the effect of ammonium rotation, particularly in the large relaxation rate and narrowly averaged quadrupole splittings of the ammonium deuterons. Dissert. Abstr.

N69-18903 Oregon Univ., Eugene.
AN EXAMINATION OF THE SHIFT OF Cs ABSORPTION LINES PERTURBED BY RARE GASES
Domingo Keng Lim Tan (Ph.D. Thesis) 1968 121 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-11959

To obtain accurate and complete information of the behaviors of shift of the entire principal series lines of Cs, the shift of all the Cs absorption lines due to the presence of all rare gases was studied experimentally. The foreign gas pressures employed were from a few cm Hg up to about 10 atmospheres. Several important experimental observations were singled out which cannot be explained by existing theories. A new model is proposed to account for the unexplained observed facts. In this model, only the Hamiltonian H_0 of the optical electron of the alkali atom is considered. The foreign atoms surrounding the alkali atom produce a perturbation on the energy levels of the latter. Based on physical arguments, the obtained most probable perturbing function $H'_m(r)$ is constant for large r and decreases to zero for small r. Author

N69-18935 National Lending Library for Science and Technology, Boston Spa (England).
FEATURES OF THE EMULSION POLYMERIZATION OF METHYL METHACRYLATE IN THE PRESENCE OF POLYOXYETHYLATED POLYOXYPROPYLENE GLYCOL AS EMULSIFIER [ISSLEDOVANIE OSOBENNOSTEI EMULSIONNOI POLIMERIZATSII METILMETAKRILATA V PRISUTSTVII EMULGATORA—ETILIROVANNOGO POLIPROPILENGLIKOLYA]
V. V. Dudukin et al Dec. 1968 8 p refs Transl. into ENGLISH from Vysokomolekul. Soedin., Ser. B (USSR), v. 9, no. 1, 1967 p 199-201
(NLL-RTS-4837) Avail: Natl. Lending Library, Boston Spa, Engl.: 7s 6d

A detailed study is presented on the polymerization of methyl methacrylate in emulsions stabilized by the nonionic emulsifier polyoxyethylated polypropylene glycol with azodiisobutyronitrile as initiator. Author

N69-18944 Florida Univ., Gainesville.
EXPERIMENTAL AND THEORETICAL ASPECTS OF N14 NUCLEAR QUADRUPOLE RESONANCE SPECTROSCOPY
William Tze-Ping Choy (Ph.D. Thesis) 1967 145 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-9462

The temperature dependence of the nuclear quadrupole resonance frequency of ^{14}N in the α-phase of solid nitrogen has been analyzed in terms of a modified Bayer theory of a molecular torsional oscillator. From theoretical and experimental evidence on the one-line spectrum and the isotope splitting, it is concluded that the frequencies of the nitrogen molecular torsional motions about the X- and Y-principal axes are the same, and have the value of 1.51×10^{12} Hz at absolute zero temperature. The resonance line shape for pure nitrogen has been found to be rather complex and to have a complicated temperature dependence. An explicit formula has been derived for the contribution of the magnetic dipolar interaction from spin one-half nuclei to the second moment of each of the two pure quadrupole resonance lines of an integer spin nucleus in the case when the electric field gradient has a small amount of axial asymmetry. Dissert. Abstr.

N69-18958 Florida Univ., Gainesville.
A NEW CHEMONUCLEAR SYSTEM FISSION FRAGMENTS AND FLUOROCARBONS
Richard Norwood Gurley (Ph.D. Thesis) 1967 197 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 68-9527

The radiolysis of (a) CF_4, (b) CF_4–UF_6, (c) CF_4–UF_6–N_2, (d) CF_4–UF_6–Ar, (e) CF_4–UF_6–Xe, (f) CF_4–UF_6–SF_6, and (g) CF_4–UF_4–C by gamma photons and by reactor irradiations was studied. The radiolysis of CF_4–UF_6–Al shavings by reactor irradiations was also studied. The principal product was C_2F_4 with traces of C_2F_6O and C_3F_6O. The parent material, CF_4, was also recovered. For the gamma irradiations, expressions were derived which related the fraction of CF_4 remaining after exposure to a known dose. For the reactor irradiations, a mathematical model which related the fraction of CF_4 remaining after exposure to a known dose was obtained. Dissert. Abstr.

N69-18962*# National Aeronautics and Space Administration. Ames Research Center, Moffet Field, Calif.
SOLVENT PURIFICATION PROCEDURES USED IN ORGANIC GEOCHEMISTRY LABORATORIES
Keith A. Kvenvolden and J. M. Hayes Washington Feb. 1969 15 p refs
(NASA-TM-X-1746) Avail: CFSTI CSCL 07D

As organic and inorganic solvents are often a source of contamination in organic geochemistry, questionnaires were sent to organic chemical laboratories on the use and purification of solvents. An analysis of the replies shows: (1) Analytical reagent grade solvents generally are unacceptable for organic geochemical use unless they are purified by some kind of column chromatography or distillation. (2) In some applications, spectroscopic grade and pesticide or nanograde quality solvents were used successfully as received from the manufacturers. (3) Pretreatment of solvents before distillation is not a common practice. (4) Laboratories reporting successful distillation techniques use simple distillation setups with good fractionating columns operated under high reflux ratios. (5) In a few instances, the level of residue contamination in solvents used for analyses was reported and varied from 10^{-7} to 10^{-9} gm/ml. (6) Techniques of fractional crystallization and zone melting seem to provide higher purity solvents than can be prepared by distillation. Author

N69-19019*# ESSO Research and Engineering Co., Linden, N. J. Government Research Lab.
STUDY OF SYNTHESIS OF GLYCEROL Annual Report, 30 Jun. 1967–30 Sep. 1968
H. E. Ramsden, W. F. Taylor, and H. A. Weiss 30 Sep. 1968 136 p refs
(Contract NAS2-4498; ESSO Proj. 4320)
(NASA-CR-73303; GR-6-SSG-68) Avail: CFSTI CSCL 06A

A process for the production of glycerol was identified and shown to be chemically feasible. The overall process consists of two chemical steps, first, selective self-condensation of formaldehyde to C_2 and C_3 sugars, and second, hydrogenation of the C_3 sugar product (glyceraldehyde and/or dihydroxyacetone) from stage I to glycerol. A separation step will be required in each step of the process, with recycle of the water solvent and other species such as unconverted feed materials. Studies with the self-condensation of formaldehyde have shown that this reaction can be carried out both homogeneously or heterogeneously to yield a selective C_2–C_3 sugar product when the activity of the reaction system is carefully controlled. High conversion levels and good selectivity have been achieved with both a CaO/Al_2O_3 and a Fe_2O_3/Al_2O_3 catalyst. The feasibility of a low pressure hydrogenation step to convert C_3 sugars such as glyceraldehyde to glycerol has been demonstrated using a 5% Ru/carbon catalyst. Excellent hydrogenation rates were obtained at 80 to 100°C using hydrogen pressures ranging from 3 to 5 atmospheres. Author

N69-19045# Notre Dame Univ., Ind. Radiation Lab.
THESAURUS FOR RADIATION CHEMISTRY. PRELIMINARY EDITION
May 1968 44 p
(Contract AT(11-1)-38)
(COO-38-621) Avail: CFSTI

The Radiation Chemistry Data Center has undertaken the collection and indexing of literature on radiation chemistry in order to facilitate the preparation of bibliographies and selection of papers for topics to be reviewed. A list of keywords that was developed for describing the papers is reported. The keywork list is followed by a formula list; a few species are indexed by their formula instead of name. The preliminary edition of the thesaurus serves as a guide in the selection of keywords for indexing the papers; new words are added frequently. Revised editions will be made available periodically. Author (NSA)

N69-19077# National Bureau of Standards, Washington, D. C.
ACTIVITIES OF THE NBS SPECTROCHEMICAL ANALYSIS SECTION Technical Note, Jul. 1966–Jun. 1967
Bourdon F. Schribner, comp. Jan. 1968 86 p refs
(NBS-TN-422) Avail: SOD: $0.45

A summary is given of activities of the NBS Spectrochemical Analysis Section for the year July 1966 through June 1967. In optical spectrometry, studies were made of (1) the effectiveness of a liquid Q-switch for laser pulse control and (2) the applicability of the high-frequency plasma torch in atomic emission and absorption spectroscopy. Two papers on laser probe spectrochemical analysis were published. In electron probe microanalysis an alignment procedure was developed for the x-ray spectrometer, data on x-ray mass absorption coefficients were collected and critically evaluated, and a review of techniques for scanning microprobe analysis was published. In x-ray spectrometry studies were made of interferences especially in the analysis of complex alloys. A combination of techniques involving enrichment by electro-deposition, stable isotope dilution, and determination by the spark source mass spectrometer has provided an accurate method for trace analysis. Author

N69-19087# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Reaktorzentrum.
DIRECT ANALYSIS OF URANIUM IN ORGANIC EXTRACTS. PART 1: EXTRACTION OF URANIUM BY 2-ETHYL-HEXYL-PHOSPHATE [DIREKTE BESTIMMUNG

VON URAN IN ORGANISCHEN EXTRAKTEN. 1. MITTEILUNG: EXTRAKTION VON URAN MIT PHOSPHORSAEUREBIS-(2-AETHYLHEXYLESTER)]

H. Sorantin and R. Wiesboeck Oct. 1968 28 p refs In GERMAN Submitted for publication
(SGAE-CH-52/1968) Avail: CFSTI

Uranium is extracted with bis-phosphoric acid-(2-ethylhexyl-ester) in toluene and quantitatively determined in its organic phase by liquid scintillation. The optimal measuring range is obtained by isoamplitude curves and uranium 235 is measured in the presence of some fission products. This proposed method determines the uranium 234 component in 1 mg enriched uranium at a relative error of ± 0.52%.

N69-19110# Toronto Univ. (Ontario). Dept. of Chemistry.

ESTIMATION OF THE NUMBER OF SELF-AVOIDING LATTICE POLYGONS

S. G. Whittington and J. P. Valleau Nov. 1968 17 p refs Supported by the NCR of Can.
(LPTHE-68/37) Avail: CFSTI

A capture–recapture technique for estimating the size of a population of linear graphs is described. Some estimates of the number of polygons weakly embeddable in the square lattice are obtained and the results support the conclusion that the probability of initial ring closure varies inversely as n^{θ}, where n is the ring size and $\theta = 11/6$ in two dimensions. Author

N69-19129*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THE DISSOCIATION ENERGY OF GASEOUS TITANIUM MONONITRIDE

Carl A. Stearns and Fred J. Kohl Washington Feb. 1969 20 p refs
(NASA-TN-D-5027) Avail: CFSTI CSCL 07D

The titanium nitride molecule has been identified in the vapor phase over solid $TiN_{0.7S}$ at temperatures above 2250°K. The Knudsen effusion method was used in conjunction with a double-focusing mass spectrometer. The high resolution of the spectrometer made possible the identification of the TiN molecule. From experimentally determined partial pressures, the enthalpy for the reaction $TiN(g) = Ti(g) + 0.5\ N_2(g)$ has been calculated as $\Delta H^{\circ}_{298} = -1.8 \pm 7$ kcal/mole (-7.5 ± 29 kJ/mole). This reaction enthalpy yields thermodynamic properties for gaseous TiN when combined with published thermodynamic data: (1) $TiN(g) = Ti(g) + N(g)$, $D^{\circ}_{298} = 111.2 \pm 8$ kcal/mole (465.3 ± 33 kJ/mole); (2) $TiN(s) = TiN(g)$, $\Delta H^{\circ}_{s,298} = 195.5 \pm 9$ kcal/mole (818.0 ± 38 kJ/mole); and (3) $Ti(s) + 0.5\ N_2(g) = TiN(g)$, $\Delta H^{\circ}_{f,298} = 114.8 \pm 8$ kcal/mole (480.3 ± 33 kJ/mole). Author

N69-19143# Michigan State Univ., East Lansing. Dept. of Chemistry.

SOME EFFECTS OF CRYSTAL STRUCTURE ON PRODUCTION OF RADICALS IN IRRADIATED CRYSTALS

Max Roger and L. D. Kispert 5 Jan. 1968 12 p refs
(Contract AT(11-1)-1385)
(COO-1385-22) Avail: CFSTI

A series of anhydrous and hydrated polycrystalline metal acetates have been irradiated at 77°K with 1 MeV electrons and the ESR spectra observed. The principal stable free radical found in the hydrated materials was methyl, whereas other species predominate in the anhydrous acetates, and methyl radical was not observed. The absolute yield of methyl radicals, as well as the ratio of methyl to other species, appeared to increase with the number of molecules of water of hydration. The radicals obtained by breaking C–C bonds are also found in irradiated acetamide and it appears that such species may be favored in crystals whose structures are largely determined by hydrogen bonding. Author (NSA)

N69-19186*# Ohio State Univ., Columbus. ElectroScience Lab.

APPROXIMATE TRANSITION PROBABILITIES AND LIFETIME OF SOME OF THE EXCITED STATES OF NEUTRAL IODINE

S. H. Koozekanani and G. L. Trusty 11 Dec. 1968 12 p refs
(Grant NGR-36-008-002)
(NASA-CR-100255; TR-1093-43) Avail: CFSTI CSCL 07D

Approximate transition probabilities and lifetime of some of the 5d, 6p, and 6s states of neutral iodine is given with the assumption that the states are purely pair coupled. Author

N69-19193# European Atomic Energy Community, Brussels (Belgium). Joint Nuclear Research Center.

THE PREPARATION OF PURE ISOTOPICALLY ENRICHED LITHIUM HYDROXIDE SOLUTIONS BY BATCH OPERATION WITH A STRONG ANION-EXCHANGER

J. Pauwels and K. F. Lauer 1968 17 p refs
(EUR-4182.E) Avail: CFSTI

A method of transformation of pure isotopically enriched salts into pure 0.1 M lithium hydroxide solutions using an anion exchanger in the hydroxyl form is described. Alkali and alkali earth contaminations are ≤ 100 μg/g Li, and residual chloride and sulfate contents ≤ 0.01 eq %. The carbonate content of the solutions is ≈ 0.25 eq %. No alterations of isotopic enrichments could be detected. Author

N69-19198# National Bureau of Standards, Washington, D. C. Inst. of Materials Research.

BIBLIOGRAPHY ON THE HIGH TEMPERATURE CHEMISTRY AND PHYSICS OF MATERIALS, OCTOBER–DECEMBER 1968

J. J. Diamond, ed. Jan. 1969 75 p refs
(NBS-SP-315) Avail: SOD $0.70

A bibliography of 664 works, most of them published during 1968, is presented. The material is arranged under the following headings: (1) devices for achieving temperatures above 1500° C, for measuring and controlling temperatures above 1500° C, and for physical measurements above 1000° C; (2) thermodynamic properties, at below 1000° C, of materials which melt above 1500° C; (3) properties, above 1000° C, of metallic, non-metallic, and mixed materials which melt above 1500° C and of those which melt below 1500° C; (4) phase equilibria above 1000° C; (5) reactions at temperatures above 1000° C and reactions between gases and condensed phases; (6) spectroscopy of interest to high temperature chemistry; and (7) books dealing with solids and liquids. Author

N69-19201# European Atomic Energy Community, Ispra (Italy). Chemistry Dept.

HALIDE SLAGGING OF RARE EARTH FISSION PRODUCTS IN MOLTEN URANIUM

G. Sennewald, C. David, and J. G. Wurm 1968 35 p refs
(EUR-4184.E) Avail: CFSTI

The extraction of cerium and lanthanum from molten irradiated uranium with a molten salt bath containing UCl_3 has been studied. The use of $U^{235}Cl_3$ as a chlorinating agent seems to be very attractive; also, U^{235} losses to the salt bath by isotopic exchange are negligible. A decontamination factor of 3×10^4 for Ce and La has been reached under the following simulated conditions: 1 kg of irradiated U (10% burnup) with 100 gr of UCl_3 in the slagging salt at 1,250°C. It was found that a limited halide slagging

of Ce and La can be performed with $CaCl_2$ and $BaCl_2$ alone without UCl_3. An attempt was made to explain this reaction mechanism. The solubility of cerium in molten cerium at 1,250°C has been redetermined to 0.0194 mol%. Author

N69-19217# Los Alamos Scientific Lab., N. Mex.
NEUTRON DIFFRACTION INVESTIGATIONS OF HYDROGEN ISOTOPES FROM 4.2 TO 0.91°K
A. S. Bulatov et al May 1968 12 p refs Transl. into ENGLISH from Zh. Eksperim. i Teor. Fiz. (Moscow), no. 54, 1968 p 390–394
(LA-TR-68-29) Avail: CFSTI

The crystal structures of normal hydrogen, normal deuterium, and para-hydrogen are studied by observing the diffraction of slow neutrons with wavelengths of 1.277 ± 0.002 A. At temperatures between 4.2 and 0.91°K, para-hydrogen and normal deuterium crystallize into hexagonal close-packed lattices with different unit cells. In the indicated temperature range, normal-composition hydrogen undergoes a phase transition of the first kind. The hexagonal close-packed lattice changes into a face-centered cubic lattice. The phase transition exhibits hysteresis. The transition point upon cooling is found to be 1.46 ± 0.02°K; upon heating, the return to the hexagonal lattice occurs at 1.68 ± 0.02°K. Author (NSA)

N69-19224# Bureau of Mines, Amarillo, Tex. Helium Research Center.
COMPRESSIBILITY FACTORS FOR HELIUM AND CARBON DIOXIDE MIXTURES AT 0 DEG, 20 DEG, 23 DEG, AND 35 DEG C AND TO 900 psia
George W. Weems and N. L. Miller Mar. 1969 44 p refs
(BM-RI-7233) Avail: Issuing Activity

The Bureau of Mines used the Burnett method and apparatus to determine the compressibility factors for helium and carbon dioxide mixtures at 0°, 10°, 20°, 23°, and 35° C and to pressures of 900 psia. Tables of compressibility factors and approximations of the virial coefficients are presented for seven binary mixtures as well as for helium and carbon dioxide. The results compare favorably with existing data. Author

N69-19234 Rochester Univ., N. Y.
THE PRESSURE DEPENDENCE OF THE LATTICE PARAMETERS AND VOLUME OF FERROMAGNESIAN SPINELS, AND ITS IMPLICATION TO THE EARTH'S MANTLE
Ho-kwang Mao (Ph.D. Thesis) 1968 209 p
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 68-9385

The molar volumes of the spinel phases of Fe_2SiO_4, $Fe_{1.8}Mg_{0.4}SiO_4$ and Ni_2SiO_4, and of magnetite, wüstite were determined up to 300 kb at room temperature by means of X-ray diffraction techniques employing diamond anvils. Crystallographic and thermodynamic considerations suggest that periclase and stishovite would be more stable than ilmenite and perovskite phases of $MgSiO_3$ under the conditions of the most part of the lower mantle. Thermodynamic calculations also indicate that $Mg_3Al_2Si_3O_{12}$ pyrope, Al_2SiO_5 kyanite, and $MgAl_2O_4$ spinel would be less stable than the high density simple oxides such as periclase, corundum, and stishovite, under the conditions of the lower mantle. Thus all the presently known phases in the $MgO–FeO–SiO_2–Al_2O_3$ system, except the simple high density oxides, would not exist in the lower mantle, and the stable phases in this system existing in the lower mantle, should be the high density oxides or some presently unrecognized phases. Dissert. Abstr.

N69-19235 Oklahoma State Univ., Stillwater.
MEASUREMENT OF THE OSCILLATORY FLOW BIREFRINGENCE OF POLYSTYRENE SOLUTIONS
John Lindblad Schrag (Ph.D. Thesis) 1967 231 p
Avail: Univ. Microfilms: HC $10.60/Microfilm $3.00 Order No. 68-8493

Solutions of three samples of different molecular weights suspended in the viscous solvent were measured using a closely spaced oscillating plane and fixed reflector system to generate the oscillatory flow. The birefringence is characterized by a mechano-optic constant S^*, measurements of which were made as functions of temperature and frequency to examine the oscillatory flow birefringence in terms of the relaxation times associated with the motions of the polymer molecule in oscillatory shear. The measured values of S^* versus frequency are compared with the values obtained by a theory which treats the oscillatory flow birefringence and the viscosity increment due to the presence of a model of a polymer chain, consisting of a chain of beads linked by Hookean springs suspended in a continuous medium. It was found that the oscillatory flow birefringence is a sensitive means for the examination of the dynamics of the motions of polymer molecules in solution. The frequency range of the apparatus may be considerably enhanced by using a temperature-frequency reduction technique provided that the solvent viscosity changes appreciably with temperature. A comparison of the measured S^* and the S^* obtained from theory indicates that the bead and spring model predictions correspond to the observed oscillatory flow birefringence, and that it will be essential to consider both the number of chain segments and the degree of hydrodynamic interaction between segments in the model to obtain an adequate description. Dissert. Abstr.

N69-19236 Florida Univ., Gainesville.
A VARIATIONAL APPROACH TO THE GROUND STATE ENERGY OF THE ELECTRON GAS
Michael Smith Becker (Ph.D. Thesis) 1967 44 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-9510

An upper bound on the ground state energy of an electron gas can be obtained by writing the energy in terms of the wave function for the system and then minimizing it with respect to variation of the wave function. The ground state energy for the system under consideration may be expressed in terms of the density and parameters a and b, as determined by variation. The calculation of an energy for a given set of a and b values involves a series of approximations which are summarized as follows: (1) The expression D^*D, which appears in the energy expression, is determined from the ideal gas ground state. (2) The energy expressions are simplified by the application of either a random phase approximation or a superposition approximation. (3) The final form of the energy expression contains the radial distribution function g(r). The radial distribution function is computed by use of either the Percus–Yevick integral equation of the Lado perturbation formula. Using the above approximations, the ground state energy for a given density is then found by computing the energy for various values of a and b until the lowest possible energy is found. This process is done over a wide range of densities and the results are compared with those obtained by different methods. Dissert. Abstr.

N69-19247# Oak Ridge National Lab., Tenn.
A COMPARISON OF SEVERAL DIFFERENT MODELS FOR FITTING DATA ON THE SOLUBILITY OF SILVER SULFATE IN AQUEOUS SOLUTIONS CONTAINING VARIOUS SUPPORTING ELECTROLYTES
M. H. Lietzke and R. W. Stoughton Oct. 1968 21 p refs
(Contract W-7405-ENG-26)
(ORNL-4325) Avail: CFSTI

Five different mathematical models for fitting solubility data were compared using data on the solubility of silver sulfate in aqueous solutions containing various supporting electrolytes. While all the models fit the data reasonably well, it is difficult to say whether any one of them fits the data better than the others. The possible existence of the $AgSO^-_4$ complex ion in solution is also discussed. Author (NSA)

N69-19250# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
SINTERING AND CRYSTALLITE GROWTH IN THORIA GEL
M. J. Bannister Jul. 1968 33 p refs Presented at the 3rd Ceramic Conf., New South Wales, Australia, Aug. 1968
(AAEC/TM-464; CONF-680820-1) Avail: CFSTI

Studies on the sintering and crystallite growth phenomena in thoria gels are described. This work includes characterization of the gel by electron microscopy, thermogravimetric analysis and differential thermal analysis, crystallite growth studies using both X-ray line broadening and quantitative electron microscopy, measurement of specific surface changes during sintering, and the use of both isothermal and non-isothermal techniques to study the shrinkage behavior of the gel. The expulsion of volatiles from the gel causes significant shrinkages below 600°C. Above 600°C, shrinkage is accompanied by crystallite growth and a decrease in specific surface. The behavior observed in both of these temperature regions is described in detail and interpreted in terms of specific volatilization or material-transport mechanisms. Author (NSA)

N69-19254# Oak Ridge National Lab., Tenn.
TRENDS AND DIFFERENCES IN THE CRYSTALLIZATION BEHAVIOR OF LANTHANIDE HYDROXIDE PREPARATIONS
R. G. Haire and T. E. Willmarth Oct. 1968 34 p refs Presented at the Rare Earth Conf. (7th), Coronado, Calif., 28–30 Oct. 1968
(Contract W-7405-ENG-26)
(ORNL-TM-2387; CONF-681020-1) Avail: CFSTI

Hydroxide preparations of the lanthanides and yttrium were obtained by precipitating the metal ions from nitrate solutions with ammonium hydroxide. The gelatinous precipitates exhibited amorphous-like diffraction patterns immediately after precipitation. Colloidal solutions of the amorphous material were obtained by extensively washing the precipitates until peptization occurred. After sufficient periods of aging, the colloidal material crystallized and this crystallization process was studied using electron microscopy, electron diffraction, and x-ray analysis. The results showed that the lanthanides could be divided into two groups, based on the crystallizing times and the microstructures obtained for the hydroxides. Examination of the amorphous solutions of both groups showed that the material consisted of 20 to 50 Å particles. Author (NSA)

N69-19285 National Lending Library for Science and Technology, Boston Spa (England).
POLYMERIZATION OF STYRENE IN THE PRESENCE OF POLYOXYETHYLATED POLYOXYPROPYLENE GLYCOL [POLIMERIZATSIYA STIROLA V PRISUTSTVII POLIOKSIETILIROVANNOGO POLIPROPILENGLIKOLYA]
V. V. Dudukin et al Dec. 1968 10 p refs Transl. into ENGLISH from Vysokomolekul. Soedin., Ser. B (USSR), v. 9, no. 1, 1967 p 196–198
(NLL-RTS-4838) Avail: Natl. Lending Library, Boston Spa, Engl.: 7s 6d

This paper presents the results of a study of the rate of styrene polymerization in emulsion, and of the average molecular weight of the polymers in the presence of polyoxyethylated polyoxypropylene glycol (PPG). The initiator was azodiisobutyronitrile (AZDN). In addition the average sizes of latex particles were studied in relation to the degree of polymerization and the emulsifier concentration. Author

N69-19287# California Univ., Livermore. Lawrence Radiation Lab.
ELECTRON PROBE MICROANALYSIS OF THE PLUTONIUM-LEAD SYSTEM
Robert F. Nickerson 23 Oct. 1968 20 p refs
(Contract W-7405-ENG-48)
(UCRL-50509) Avail: CFSTI

The electron probe microanalyzer was used to determine the chemical compositions of the many phases that exist in the plutonium–lead binary alloy system. Probe analysis helped to identify these phases as having the following stoichiometries: Pu_3Pb, Pu_5Pb_3, Pu_5Pb_4, Pu_4Pb_5, $PuPb_2$, and $PuPb_3$. The applicability of the Ziebold–Ogilvie empirical method for quantitative analysis of this system was established and its applicability to similar systems where no standards are available is also shown. Author (NSA)

N69-19288# Pittsburgh Univ., Pa. Dept. of Chemistry.
A THEORETICAL INVESTIGATION OF THE VIBRATIONAL PROPERTIES OF HYDROGEN IN TRANSITION METAL AND LANTHANIDE METAL HYDRIDES Annual Report, 1 Dec. 1967–30 Nov. 1968
David P. Schumacher Nov. 1968 24 p refs
(Grant NSF GP-5521-X)
Avail: Issuing Activity

The infrared absorption spectra of magnesium hydride was investigated experimentally to check some discrepencies in the spectra published by Mal'tseva and Kharitonov. The region of 33 cm^{-1} to 4500 cm^{-1} was investigated on powdered samples of MgH_2 in KBr and nujol matrices. The results on MgH_2 indicated a broad window at 1800 cm^{-1} and four absorption peaks at 88.75, 92.9, 133.6, and 139.7 cm^{-1}. Calculations are being carried out on the three-dimensional system assuming a unit Mg–H molecular cell which does not interact with other cells and a lattice vibration model which takes into account the frequency distribution over the whole crystal. Author

N69-19289# Idaho Nuclear Corp., Idaho Falls.
A LABORATORY DISSOLUTION AND RADIOCHEMICAL ANALYSIS OF A URANIUM, CALCIUM, AND ZIRCONIUM OXIDE NUCLEAR FUEL
R. C. Girton, J. G. Scott, and G. A. Huff Oct. 1968 13 p refs
(Contract AT(10-1)-1230)
(IN-1223) Avail: CFSTI

A method is described for the dissolution of a UO_2–Ca-stabilized ZrO_2 nuclear fuel by a pyrosulfate fusion technique. Certain fission products (^{99}Mo, ^{143}Ce, ^{140}La, ^{140}Ba, and ^{103}Ru) were analyzed by various procedures to determine nuclide concentrations used in burnup calculations. The percent recovery of the nuclides and an explanation of the burnup calculations for up to 100 transients are discussed. Author (NSA)

N69-19283*# Bell Telephone Labs., Inc., Murray Hill, N. J.
POLYMER CRYSTALS—GOOD AND BAD
H. D. Keith *In* Army Natick Labs. Polymer Struct. and Mech. Properties Apr. 1967 p 132–147 (See N69-19276 08-18)
Avail: CFSTI CSCL 20B

A brief historical review is presented of research in the area of folded conformations of linear chain molecules in lamellar polymer crystals. Two different theoretical approaches were taken to explain the folding phenomenon: equilibrium theory and the

kinetic approach. The majority of work was done on polyethylene. The relationship between crystallization and morphology of polymers is also discussed. B.P.

N69-19284*# Mainz Univ. (West Germany). Laboratorium fuer Physik der Hochpolymeren.
ON THE STRUCTURE OF DISORDERED REGIONS IN POLYETHYLENE SINGLE CRYSTALS AND IN DRAWN POLYETHYLENE
Erhard W. Fischer, H. Goddar, and G. F. Schmidt *In* Army Natick Labs. Polymer Struct. and Mech. Properties Apr. 1967 p 148-182 refs Supported by Deutsche Forschungsgemeinschaft (See N69-19276 08-18)
Avail: CFSTI CSCL 07D

To obtain additional information about the structure of the disordered regions in single crystals and drawn polyethylene, the density of these regions was determined by measuring the absolute value of the scattered intensity in the small angle range and by measuring the intensity changes due to iodine staining. For single crystal mats, experiments yielded the result that the chain molecules are not regularly folded at the surface of the crystallites. The experimental data can be explained by a random reentry model of the chain molecules. Measurements of the scattering power of drawn polyethylene result in a very low density difference between crystalline and disordered regions in the case of unannealed fibers. Comparing the scattering power of unannealed and annealed drawn polyethylene and measuring the X-ray small angle intensity of iodine stained fibers, a fivefold increase of density difference results. In addition, from the experiments on iodine stained drawn polyethylene a definite proof of the existence of chain folds in polymer fibers is obtained. Author

N69-19285*# Chemstrand Research Center, Inc., Durham, N. C.
REGULAR CRYSTALLOGRAPHIC CHAIN-FOLDING IN POLYETHYLENE CRYSTALS
Paul H. Lindenmeyer *In* Army Natick Labs. Polymer Struct. and Mech. Properties Apr. 1967 p 183-214 refs (See N69-19276 08-18)
Avail: CFSTI CSCL 07D

A presentation is made of the existence of experimental and theoretical evidence for regular crystallographic folding in polyethylene crystals. Regular crystallographic chain folding is a metastable state which results under certain crystallization conditions as a consequence of the kinetics of crystallization. A polymer molecule folds because it can lower its free energy by folding. For a fixed distribution of molecular lengths the folded chain crystal is the most thermodynamically stable form. A calculation was made of the free energy associated with the crystal thickness of a polymer crystal. B.P.

N69-19286*# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Chemistry.
DENSITY AND HEAT OF FUSION OF FOLDED CHAIN POLYETHYLENE CRYSTALS
Bernard Wunderlich, Fumiyuki Hamada, Takuji Sumida (Kyoto Univ.), Seiichi Hayashi (Kyoto Univ.), and Akio Nakajima (Kyoto Univ.) *In* Army Natick Labs. Polymer Struct. and Mech. Properties Apr. 1967 p 215-245 refs Supported in part by NASA (See N69-19276 08-18)
Avail: CFSTI CSCL 07D

The flotation method of density determination for solution grown crystals of polyethylene is shown to be a reliable method if sufficient care is taken in preparing the crystals for density measurement. With varying crystallization temperature and molecular weight the measured density varied between 0.983 and 0.998 g cm^{-3}. The density is shown to vary with surface structure as well as lamellar thickness. The heat of fusion of solution grown crystals is proportional to specific volume as long as the fold length stays constant. Different fold length crystals show different specific volume-heat of fusion relationships. Author

N69-19287*# Bristol Univ. (England). Wills (H. H.) Physics Lab.
SOME NEW AVENUES IN POLYMER SINGLE CRYSTAL STUDIES
Andrew Keller *In* Army Natick Labs. Polymer Struct. and Mech. Properties Apr. 1967 p 246-259 refs (See N69-19276 08-18)
Avail: CFSTI CSCL 20B

A new method of controlled crystal growing is presented for studies dealing with polymer chain folding characterization. The rate of crystallization of polyethylene in xylene was found to depend on the dissolution temperature (T_s) up to about 106°C, beyond which further raising of the temperature no longer had any effect. Within this dissolution range the number of crystals which formed on subsequent crystallization decreased with increasing T_s. The resulting crystals were all of uniform size indicating that they grew from preexisting polymer nuclei. Visualization of the edges and steps and the surface textures of polymer crystals was considered using the decoration technique. A brief discussion is presented on the molecular weight distribution of selectively degraded polyethylene crystals. B.P.

N69-19288*# Reading Univ. (England). Thomson (J. J.) Physical Lab.
ON THE REGULARITY OF POLYMER FOLD SURFACES
David Clifford Bassett *In* Army Natick Labs. Polymer Struct. and Mech. Properties Apr. 1967 p 260-274 refs (See N69-19276 08-18)
Avail: CFSTI CSCL 20B

Moiré patterns observed in the electron microscope were compared and contrasted for polyethylene (PE), polyoxymethylene (POM), and isotactic poly(4-methylpentene-1) (P4MP), bilayer crystals were all grown by crystallization of supersaturated dilute solutions. The main conclusions reached were that (1) mixed stacking with adjacent reentry occurs in POM and P4MP; (2) that PE folds have regular geometries, the evidence is consistent with ordered or mixed stacking with adjacent reentry; and (3) that the occurrence of isolated partial dislocations in PE and P4MP and terminating moiré fringes in POM can be explained in terms of fold packing. B.P.

N69-19289*# Mellon Inst., Pittsburgh, Pa.
CHARACTERIZATION OF CHAIN FOLDS IN CRYSTALLINE POLYMERS. A STATISTICAL PROBLEM
T. G. Fox and Hershel Markovitz *In* Army Natick Labs. Polymer Struct. and Mech. Properties Apr. 1967 p 275-283 (See N69-19276 08-18)
Avail: CFSTI CSCL 20B

A mathematical concept of chain folding in a polymer single crystal is suggested based on appropriate probability distributions. The parameters are defined which describe the length and position on the crystal face of the ends of a given loop or folds and a distribution function is evaluated which specifies the probability of occurrence of loops of different lengths and orientations relative to the crystal lattice. B.P.

N69-19293*# University of Southern Calif., Los Angeles. Dept. of Chemistry.
MULTIPLE TRANSITIONS IN POLYALKYL METHACRYLATES

Robert A. Haldon and Robert Simha (Weismann Inst. of Sci.) *In* Army Natick Labs. Polymer Struct. and Mech. Properties Apr. 1967 p 380–409 refs (See N69-19276 08-18)
(Grant NsG-343)
Avail: CFSTI CSCL 07D

A series of polyalkyl methacrylates, two hydroxylated methacrylates, polymethoxy ethyl metacrylate, and polymethyl acrylate were studied by linear expansion and torsion pendulum measurements in the temperature range from −180°C to just above the respective glass transition temperatures. The length–temperature (L–T) data were analyzed by a least squares differentiation procedure, based on moving arcs, to give directly the thermal expansion coefficients as a function of temperature. The L–T measurements suggest the existence of two T_{gg} transitions ($T_g - 100 < T_{gg} < T_g$) in the polymers with the more flexible side chains, and one transition for polymers with bulky side groups. There is also evidence of a third T_{gg} transition at about −120 to −90°C, which may be associated with adsorbed water molecules. In similar fashion to that of T_g, the location of the T_{gg} transitions decreases upon increasing the length of the n-alkyl side chain. The hydroxylated polymers have higher T_g's than the corresponding alkyl samples, and have thermal expansion coefficients only about one half as large, both features being a result of interchain hydrogen bonds. Torsion pendulum measurements indicate only one clear cut T_{gg} transition region; hence it seems that the two T_{gg} transitions observed in the expansion studies cannot be unequivocally resolved by dynamic measurements. Author

N69-19316# Mound Lab., Miamisburg, Ohio.
STABLE GASEOUS ISOTOPE SEPARATION AND PURIFICATION: APRIL–JUNE 1968
8 Nov. 1968 41 p refs
(MLM-1521) Avail: CFSTI

Studies on carbon isotope separation including distillation and thermal diffusion were continued. Chemical exchange of carbon dioxide-carbamate using a methoxy propylamine-methanol solution was further investigated. Developments in the separation of stable gaseous isotopes of Ar, Kr, Ne, and Xe are reported. Progress in thermal diffusion research on transport and column properties is also reported. New values for Kr and Xe transport coefficients are presented. Calculations for thermal transpiration in low temperature research are included. NSA

N69-19322# Florida State Univ., Tallahassee. Dept. of Chemistry.
STRUCTURAL STUDIES OF METAL COORDINATION COMPOUNDS Progress Report, Mar. 1, 1967–Oct. 1, 1968
James V. Quagliano 26 Nov. 1968 11 p refs
(Contract AT(40-1)-2503)
(ORO-2503-10) Avail: CFSTI

Systematic investigations were made of the donor properties of cation ligands formed by monoquaternization of 1,4-diazabicyclo-[2.2.2.]octane (Dabco). Protonated Dabconium cations react with halides of divalent transition metals, Mn through Zn, to form high-spin, four-coordinate complex species having a pseudo-tetrahedral stereochemistry with C_{3v} symmetry. The reactions of divalent nickel halides with various organic cations are being studied. NSA

N69-19340 Florida Univ., Gainesville.
NEUTRON DIFFUSION PARAMETERS OF PERFLUORO-DIMETHYLCYCLOHEXANE USING A TWO REGION PULSED-NEUTRON TECHNIQUE
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-9513

A technique was developed for determining the previously unknown thermal neutron diffusion parameters, Σ_a and D, of a moderating material, perfluorodimethylcyclohexane, of which there was an insufficient amount to perform the usual static and/or pulsed neutron experiments. A two region cylindrical system consisting of the material with unknown properties in the core region and a water reflector was pulsed with neutrons, and the subsequent time behavior of the neutron population was recorded as the decay curve. A piece-wise-fit method was developed to analyze the slope of this curve and to find the fundamental decay constant. As the height of the system was changed, different decay constants were obtained and plotted against the axial buckling for the various systems. Dissert. Abstr.

N69-19344# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
EMISSION SPECTRA OF MOLECULAR GASES EXCITED BY 10 keV ELECTRONS
Dietmar E. Rothe and David J. McCaa Dec. 1968 70 p refs
(CAL-TR-165; W/A-85-905) Avail: CFSTI

A systematic investigation has been made of the spectra of N_2, NO, O_2, H_2O, H_2, CO and CO_2, excited by a 10 keV electron beam of 100 micro-amperes current, in the wavelength range between 2800 and 6600 Å. The observed spectra are presented with the identifications of observed emission lines and bands. For certain band systems of N_2^+, O_2^+, CO^+, CO, and CO_2^+ the variation of intensity with pressure has also been measured over the pressure range of 10 to 100 microns Hg. Possible mechanisms associated with this pressure dependence are given where intensity does not vary linearly with pressure. A preliminary study has also been made of the effects caused by the presence of other gases on the beam-excited emission of N_2^+. Theoretical arguments are presented to show that, for the gases considered, the only important cross-excitation mechanisms are excitation by secondary electrons and quenching by inelastic collisions. Author

N69-19362# Los Alamos Scientific Lab., N. Mex.
SEPARATION AND SPECTROCHEMICAL DETERMINATION OF 0.5 TO 5 ppm NIOBIUM, TANTALUM, AND TITANIUM IN URANIUM
H. M. Burnett, J. V. Pena, C. J. Martell, and R. J. Phalps 1 Nov. 1968 19 p refs
(Contract W-7405-ENG-36)
(LA-3985) Avail: CFSTI

Microgram quantities of niobium, tantalum, and titanium are separated from uranium and determined by emission spectrochemical analysis. The elements are extracted into chloroform as complexes of N-benzoylphenylhydroxylamine (BPHA) from a 10N hydrochloric acid solution of the uranium. The chloroform extract is treated first with aqueous iron (II) and then with citric acid to remove vanadium and iron interferences. The organic material is removed by evaporation and ignition; the residue is dissolved in a hydrochloric–hydrofluoric acid mixture. The solution of extracted elements is evaporated on the ends of graphite electrodes, then excited by spark discharge. For samples containing 5.0 grams of uranium, the method covers the concentration range of 0.5 to 5.0 ppM. Standards are processed in the same manner as samples. Author (NSA)

N69-19379*# Florida Univ., Gainesville. Dept. of Chemical Engineering.
SYNTHESIS OF ELASTOMERS FOR USE WITH LIQUID FLUORINE Annual Interim Report
Henry C. Brown and A. R. Mukherjee 15 Sep. 1968 63 p refs
(Contract NSR-10-005-047)
(NASA-CR-100155) Avail: CFSTI CSCL 11J

Efforts continued on the synthesis of elastomeric polymers that will be resistant to the strong oxidizing effect of fluorine, oxygen difluoride, nitrogen tetroxide and similar agents. The research

was devoted principally to finding suitable initiators for homo- or copolymerization of hexafluorobutyne-2 under milder conditions, and to the synthesis of perfluoro mono- and diisocanates from the corresponding hydroxamic acids, their purification, and attempted synthesis of new monomers from the monoisocyanates. Chlorine radicals generated by ultraviolet radiation from chlorine and chlorine compounds were found to initiate polymerization rapidly and efficiently. Three isocyanates were prepared through the hydroxamic route, and the isocyanates were thoroughly purified. B.G.D.

N69-19382# Japan Atomic Energy Research Inst., Tokyo.
RADIATION INDUCED GRAFT COPOLYMERIZATION OF STYRENE TO POLYETHYLENE SINGLE CRYSTAL AGGREGATE FILM
Eiichi Fukada et al Dec. 1968 12 p refs Transl. into ENGLISH from Chem. High Polym. (Tokyo), v. 24, no. 272, Dec. 1967 p 795–800
(NSJ-Tr-143) Avail: CFSTI

The radiation induced graft polymerization of styrene has been carried out onto polyethylene single crystal aggregate films, which have been crystallized and annealed at various temperatures. The long period and density of the film increase with the increase of crystallization and annealing temperatures. Correspondingly, the grafting efficiency decreases with the increase of crystallization and annealing temperatures. The equilibrium absorption of styrene in the film increases with the increase of crystallization temperature, which seems to indicate the rough overlap of lamella surfaces at higher crystallization temperature. It decreases, however, with the increase of annealing temperature which causes the thickening of lamellae. It is concluded that the graft polymerization is ainly produced at the surface of the lamellar crystals. Author

N69-19386# Japan Atomic Energy Research Inst., Tokyo.
RADIATION-INDUCED POLYMERIZATION OF VINYL ETHERS
Tsutomu Naruse et al Dec. 1968 14 p refs Transl. into ENGLISH from Kogyo Kagaku Kyokaisi (Tokyo), v. 70, no. 4, Apr. 1967 p 580–583
(NSJ-Tr-142) Avail: CFSTI

A study has been made of the radiation-induced polymerization of some vinyl ethers to elucidate its mechanism. The polymerization was investigated on both conventionally and extremely dried monomer systems at 25°C. In conventionally dried monomers the rate of polymerization was unaffected by ammonia added as a proton scavenger, whereas the addition of radical scavengers showed a marked retardation effect. These results indicate the participation of a radical mechanism in these systems. The polymerization of n-butyl vinyl ether under extremely dried condition was studied. The G(-monomer)-value obtained in this case was about 25 times higher than those in conventionally dried systems, the rate being markedly increased. The rate of polymerization was found to be strongly retarded by addition of a very small amount of ammonia or methanol. These results were interpreted in terms of a cationic mechanism involving free ion. From the experimental results on the system containing ammonia, the propagation rate constant at 25°C was estimated to be 8.4×10^7 mol $^{-1}$ sec $^{-1}$. Author

N69-19388# Japan Atomic Energy Research Inst., Tokyo.
FUNDAMENTAL STUDIES ON THE ION EXCHANGE SEPARATION OF ISOTOPES, (IX). SEPARATION FACTOR OF URANIUM ISOTOPES (3)
Kozo Gonda et al Dec. 1968 12 p refs Transl. into ENGLISH from Nippon Genshiryoku Gakkaishi (Tokyo), v. 9, no. 7, Jul. 1967 p 376–381
(NSJ-Tr-144) Avail: CFSTI

Breakthrough experiments were carried out to study ion exchange separation of uranium isotopes. Four kinds of solutions containing natural uranium (mole fraction of ^{235}U $0.720_0 \times 10^{-2}$, were passed through 100 cm long, 1.3 cm diameter anion exchange resin columns until the composition of the effluents become equal to that of the feed solutions. Near the front of the breakthrough of one solution, the ^{235}U was found enriched to $0.732_4 \times 10^{-2}$ (enrichment factor 1.017), while in the case of another solution, ^{235}U was depleted to $0.710_7 \times 10^{-2}$ (enrichment factor 0.987). From the total amounts of ^{235}U enriched or depleted by these breakthrough experiments, single process ion exchange separation factors of uranium isotopes were estimated to be 1.000000, 1.00033, 0.99989, and 0.99988 for the four solutions. Based on these data, the apparent equilibrium coefficients of the electron exchange reaction, were estimated to be 1.0010 and 1.0013 for TnOA/benzene and TBP/benzene systems, respectively. These values are smaller than the value of 1.0020 obtained for 8 M hydrochloric acid in the previous paper. The apparent equilibrium coefficient of the electron exchange reaction in the anion exchange resin was estimated to be 1.0010–1.0013. Author

N69-19399# Joint Publications Research Service, Washington, D. C.
ELECTROOPTICAL PROPERTIES OF LYOPHOBIC COLLOIDS
N. A. Tolstov et al 10 Feb. 1969 12 p refs Transl. into ENGLISH from Kolloidn. Zh. (Moscow), no. 6, 1966 p 881–887
(JPRS-47415) Avail: CFSTI

The electrooptical method of studying colloids in a rotating field proved the existence and dominating role of a rigid electric dipole moment $\vec{\mu}$ of a number of colloidal particles (including bacteria) in water. The $\vec{\mu}$ of all the particles investigated is directed along their long axis. The value of $\vec{\mu}$ (4 to 6×10^{-12} CGS), and those of water-dipoles inclination to the surface of the particles ($\approx 80°$) were determined for some bacteria. It was shown that the μ of protein molecules corresponds to the same angles of inclination. It was proven that the spontaneous polarization of the monomolecular adsorbed layer of dipole molecules corresponds to lower energy values than does the orientation that is normal to the surface. Author

N69-19417# European Atomic Energy Community, Brussels (Belgium).
RESEARCH INTO THE PROBLEMS RAISED BY THE TREATMENT OF EFFLUENTS CONTAINING DETERGENTS AND COMPLEXING AGENTS [ETUDE DES PROBLEMES POSES PAR LE TRAITEMENT DES EFFLUENTS CONTENANT DES DETERGENTS ET DES COMPLEXANTS]
J.-L. Verot, J.-M. Blum, J. Hazera, and R. Sarfati Oct. 1968 66 p In FRENCH; ENGLISH summary
(Contract EURATOM-003-65-3-WASF)
(EUR-4192.F) Avail: CFSTI

Radioactive effluents, usually of low specific activity, raise certain problems for processing plants. These effluents come from hot laundries as well as from equipment decontamination workshops; they contain washing products consisting of sequestering and non-redepositing builder detergents. An inquiry was therefore undertaken at a number of research centers and nuclear power plants in the European community the aim being to draw up a catalogue of the problems which decontamination and the waste processing were liable to raise. A solution was sought which would result in an improvement in the processing of effluents from decontamination plants. The problems studied with a view to facilitating the treatment of effluents in the evaporators included the photochemical destruction of sequestrants, the displacement of the EDTA complexes, and the use of new foam-inhibitors. The inquiry ended with research into and the development of new washing

formulas and decontaminating agents with which it is possible to decontaminate effluents by conventional methods or by zeolites. Author

N69-19463# European Atomic Energy Community, Ispra (Italy). Reactor Physics Dept.

DISAPPEARANCE OF A LOW FREQUENCY KH_2PO_4 MODE UPON TRANSITION TO THE FERROELECTRIC PHASE

Ch. Schenk, E. Wiener, B. Weckermann, and W. Kley 1968 18 p refs

(EUR-4189.E) Avail: CFSTI

With the aid of a cold neutron spectrometer, the time-of-flight spectra of single crystals of KH_2PO_4 and KD_2PO_4 were measured for different orientations of the momentum exchange vector with respect to the crystallographic axes. For the KH_2PO_4 case with the momentum exchange vector pointing mainly in the direction of the hydrogen bond, the temperature dependence of the spectrum was investigated. It was found that the broad incoherent band around 50 cm^{-1} appearing strongly in KH_2PO_4 at room temperature disappears below the Curie temperature and that the mean-square displacement of the protons in the direction of their bonds is greatly reduced. Author

N69-19476# National Research Council of Canada, Ottawa (Ontario).

AUTOXIDATION OF HYDROCARBONS, 24–26

H. Hock and F. Ernst 1968 43 p refs Transl. into ENGLISH from Chem. Ber. (Weinheim/Bergstr., Ger.), v. 92, no. 11, 1959 p 2716–2740

(NRC-TT-1343) Avail: CFSTI

CONTENTS:

1. AUTOXIDATION OF HYDROCARBONS. 24: HYDROPEROXIDES FROM METALLIZED HYDROCARBONS, PART 1 p 2–11 refs (See N69-19477 08-06)

2. AUTOXIDATION OF HYDROCARBONS. 25: HYDROPEROXIDES FROM METALLIZED HYDROCARBONS, PART 2 p 12–23 refs (See N69-19478 08-06)

3. AUTOXIDATION OF HYDROCARBON. 26: AUTOXIDATION OF ARYL-METAL COMPOUNDS AND ALKALI-AROMATIC ADDUCTS p 24–35 refs (See N69-19479 08-06)

N69-19477# National Research Council of Canada, Ottawa (Ontario).

AUTOXIDATION OF HYDROCARBONS. 24: HYDROPEROXIDES FROM METALLIZED HYDROCARBONS, PART 1

In its Autoxidation of Hydrocarbons, 24–26 1968 p 2–11 refs (See N69-19476 08-06)

Avail: CFSTI

Molecular oxygen reacts with alkyl compounds of lithium, magnesium, zinc, cadmium, boron and aluminum, producing alkyl-metal peroxides, which can be hydrolysed to the corresponding alkyl hydroperoxides. In organic compounds of alkali and magnesium, the conversion takes place almost instantaneously at −150°C. At −10 to +10°C the respective hydroperoxides can be produced from organic compounds of zinc or cadmium in yields of over 90% of the theory. Author

N69-19478# National Research Council of Canada, Ottawa (Ontario).

AUTOXIDATION OF HYDROCARBONS. 25: HYDROPEROXIDES FROM METALLIZED HYDROCARBONS, PART 2

In its Autoxidation of Hydrocarbons, 24–26 1968 p 12–23 refs (See N69-19476 08-06)

Avail: CFSTI

Autoxidation of cyclohexyl magnesium chloride, hexamethylene magnesium chloride and indenyl-(3)-lithium at low temperatures (2) followed by hydrolysis, the corresponding hydroperoxides were obtained. Author

N69-19479# National Research Council of Canada, Ottawa (Ontario).

AUTOXYDATION OF HYDROCARBON. 26: AUTOXYDATION OF ARYL–METAL COMPOUNDS AND ALKALI–AROMATIC ADDUCTS

In its Autoxidation of Hydrocarbons, 24–26 1968 p 24–35 refs (See N69-19476 08-06)

Avail: CFSTI

After autoxydation of aryl–lithium and aryl–magnesium compounds at −150 or −75°C, no arylperoxy compound was detectable. Adducts of alkali metals on polynuclear aromatic hydrocarbons, when dissolved in glycoldimethyl ether or tetrahydrofurane, react with excess oxygen even at −75°C, giving metal peroxide accompanied by the initial hydrocarbon. Author

N69-19481# Argonne National Lab., Ill. Chemistry Div.

ENERGY LEVELS AND INTENSITIES IN THE SOLUTION ABSORPTION SPECTRA OF THE TRIVALENT LANTHANIDES

W. T. Carnall, P. R. Fields, and K. Rajnak Mar. 1968 92 p refs

(Contract W-31-109-ENG-38)

(ANL-7358) Avail: CFSTI

A theoretical interpretation of the solution absorption spectra of the trivalent lanthanides is presented. The extent to which experimentally measured energies and intensities of the bands can be correlated with those computed from theory is examined. The comparison technique was used to identify as many levels as possible in the solution spectrum of a given lanthanide. The next step was to determine values for the interelectronic repulsion and spin-orbit coupling parameters that would generate a set of calculated energy levels in good agreement with the observed data. The description of states implicit in these parameters was then used directly in the intensity calculations. The intensity calculations were used as a basis for making numerous new assignments to bands observed in the uv region. Sets of electrostatic and spin-orbit parameters were then derived by a least squares analysis of data which included the new assignments. Author (NSA)

N69-19512# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Physikinstitut, Reaktorzentrum.

RESULTS WITH THE SUMMING HALBLEITER–COMPTON SPECTROMETER [ERGEBNISSE MIT DEM SUMMIEREN-DEN HALBLEITER–COMPTON SPEKTROMETER]

R. Papelnik and H. Hick Sep. 1968 21 p refs In GERMAN; ENGLISH summary Presented at Herbsttagung der Oesterr. Physik. Ges., Graz, Austria, Sep. 1968 Submitted for publication

(SGAE-PH-70/1968) Avail: CFSTI

Preliminary measurements were made with two planar detectors, the second detector being displaced with respect to the primary beam. This summing Compton spectrometer has an intrinsic peak efficiency of 0.02% for Cs 137 and 0.01% for Co 60. This peak efficiency is 2.6% relative to that of the photopeak spectrometer, for Cs 137. A large detector with bore-hole will increase the efficiency of the summing Compton spectrometer by a factor of 10. The advantage of the summing Compton spectrometer is the enormous peak-to-tail ratio, which had been measured to be ~400 : 1 for Cs 137 and ~370 : 1 for Co 60. The peak fraction is

89% for Cs 137 and 83% for Co 60. The corresponding values for the single detectors are 5.5% and 1.6%. The spectrometer is therefore especially useful for complex spectra, as e.g., in the analysis of reactor fuels for burn-up determination; not only all Compton edges are removed but the double escape peaks are reduced too. Author

N69-19544 Arkansas Univ., Fayetteville.
THE STRUCTURE OF LIQUIDS CONTAINING TETRAHEDRAL MOLECULES AS DETERMINED FROM X-RAYS ANALYSIS
Robert Edward Graham, Jr. (Ph.D. Thesis) 1968 150 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-9647

Diffraction patterns were obtained for CCl_2F_2 at −158°C, $Sn(CH_3)_4$ at 23°C and −63°C, and SnI_4 at 176°C and 250°C. Atomic radial distribution functions were calculated and an ideal peak analysis used to determine the intramolecular bond lengths in these substances when in the liquid state. The substances were treated assuming molecules of the compounds were distinguishable in the liquid, and molecular radial distribution functions were calculated in each case. The results were used along with molecular distributions for CF_4 and CCl_4 to form a sequence of liquids containing tetrahedral molecules of increasing size. The trends in the sequence are examined, and it is shown that there are preferred orientational effects present in such liquids. Dissert. Abstr.

N69-19559 National Lending Library for Science and Technology, Boston Spa (England).
INDUSTRIAL ELECTROLYZERS FOR THE SYNTHESIS OF ORGANIC COMPOUNDS [PROMYSHLENNYE ELEKTROLIZERY DLYA SINTEZA ORGANICHESKIKH SOEDINENII]
A. P. Tomilov Dec. 1968 20 p refs Transl. into ENGLISH from Khim. Prom. (Leningrad), v. 44, no. 2, 1968 p 84–91
(NLL-RTS-4799) Avail: Natl. Lending Library, Boston Spa, Engl.: 20s

Various industrial electrolyzer designs are depicted and analyzed; they were specifically involved in the electrochemical syntheses of organic products. A description is given of a simple multipurpose experimental electrochemical apparatus with a rated load of 300 amps. In this apparatus it was only possible to carry out the electrolysis of homogeneous systems with good electrical conductivity, since it did not provide for the removal of large amounts of Joule effect heat. In addition, the productivity per unit volume of the electrolyzer was low. Solutions for increasing the productivity of an electrolyzer are presented: using porous electrodes, enlarging the cathode surface by fixing supplementary vanes, enlarging the electrode surface by bringing the electrodes close together, etc. Effective cooling of the electrolyte (removal of Joule effect heat) can be achieved by installing external condensers, and performing other mentioned manipulations on increasing the cooling surfaces. B.P.

N69-19569 National Lending Library for Science and Technology, Boston Spa (England).
PROGRESS IN THE ELECTROCHEMICAL PRODUCTION OF ORGANIC COMPOUNDS [USPEKHI V OBLASTI ELEKTROKHIMICHESKOGO POLUCHENIYA ORGANICHESKIKH SOEDINENII]
M. Ya. Fioshin et al Dec. 1968 27 p refs Transl. into ENGLISH from Khim. Prom. (Leningrad), v. 43, no. 4, 1967 p 243–252
(NLL-RTS-4748) Avail: Natl. Lending Library, Boston Spa, Engl.: 25s

A review of the field for application of electrosynthesis for the production of various organic compounds is presented. Included are: electrochemical reduction of radicals containing nitrogen, carboxylic acids, carbonyl compounds, unsaturated compounds, and heterocyclic compounds; electrochemical oxidation of carboxylic acids, heterocyclic compounds, alcohols and aldehydes; and electrochemical synthesis of organometallic compounds, and anodic substitution. F.O.S.

N69-19576# National Research Council of Canada, Ottawa (Ontario).
CHAIN TRANSFER IN RADICAL POLYMERIZATION [KETTENUEBERTRAGUNG BEI DER RADIKALISCHEN POLYMERISATION]
G. Henrici-Olive and S. Olive 1968 108 p refs Transl. into ENGLISH from Fortschr. Hochpolymer. Forsch. (Berlin), no. 2, 1960–1961 p 496–577
(NRC-TT-1341) Avail: CFSTI

The formal kinetic principles by which transfer constants can be determined are summarized, with consideration given to the variable molecular weight distribution and any changes that may occur in the velocity. Tabulated data are presented to facilitate the application of the formulas derived and the construction of the formula required for the evaluation of special cases. Also discussed are the chain transfer in the three examples of styrene (termination by combination), methylmethacrylate (combination and disporportionation), and vinyl acetate (negligible termination by combination). Author

N69-19577 National Lending Library for Science and Technology, Boston Spa (England).
THE SPECTROPHOTOMETRY OF FURFURAL IN THE 320–600 mmk RANGE [SPEKTROFOTOMETRIYA FURFUROLA V OBLASTI 320–600 MMK]
V. G. Kul'nevich et al Dec. 1968 7 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii. Lesn. Zh. (Archangelsk), v. 10, no. 6, 1967 p 134–137
(NLL-RTS-4827) Avail: Natl. Lending Library, Boston Spa, Engl.: 10s

Investigations were carried out on the variability of the spectrum of furfural during autooxidation, the thickness of the tested layer being 0.06 mm. Freshly distilled furfural was used as standard. A spectrophotometer with a quartz cell was employed. An incandescent lamp was used as a light source thus making it possible to record spectra in the extreme UV- and IR-regions (320–800 mμ). The starting material (purified furfural) was divided into the material, which was to be tested, and the standard, which was stored in a dark glass bottle in a refrigerator and used for replenishing the control cell. It was established that, due to the influence of various factors, the spectrum of furfural is subjected to changes in the IR- to UV-range when λ = 320–380 mμ. In the absence of a solvent and by using the original furfural as standard it was possible to record even minute changes in the tested sample. Author

N69-19590# National Research Council of Canada, Ottawa (Ontario).
EQUILIBRIA OF THE IRON–CARBON–OXYGEN SYSTEM IN THE TEMPERATURE AND CONCENTRATION RANGE OF MOLTEN STEEL AND THE MANNER IN WHICH THESE ARE INFLUENCED BY PHOSPHORUS, MANGANESE AND SULPHUR
Hermann Schenck et al 1968 15 p refs Transl. into ENGLISH from Arch. Eisenhuetterw. (Duesseldorf), v. 37, no. 7, 1966 p 545–550
(NRC-TT-1346) Avail: CFSTI

Deviations in existing formulas for the equilibrium between oxygen and carbon in liquid iron gave rise to renewed measurements

with refined and modified auxiliary means. The influence of manganese, phosphorus, and sulfur on the relations was also investigated. The tests yielded the values and temperature dependence of the equilibrium constants for O, C, and C, O as well as the interaction parameters which are relations between pressure and composition of the gas phase and the composition of the metal melts in equilibrium with the gas phase with respect to their carbon, oxygen, manganese, phosphorus, and sulfur contents. From these parameters the inverse interaction parameters may be computed by means of known equations. The relations were expressed and it was shown in which manner the influence of alloying elements can be expressed by a change in the pressure parameter. Author

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N69-18667*# General Dynamics/Convair, San Diego, Calif.
MEASUREMENT AND ANALYSIS OF RADIO FREQUENCY NOISE IN URBAN SUBURBAN, AND RURAL AREAS Final Report, Jul. 1967–Jun. 1968
A. H. Mills 1 Feb. 1969 125 p refs
(Contract NAS3-9714)
(NASA-CR-72490; GDC-AWV68-001) Avail: CFSTI CSCL 17B

The radio frequency noise environment in Phoenix, Arizona was measured over 2.5 MHz bandwidths centered at 300 MHz, 1 GHz, and 3 GHz, with a receiving system having a noise figure of 3 db. The objectives of the measurement program are presented with a description of the measurement tasks. Equipment and methods used to conduct preliminary and detailed surveys are described. A preliminary analysis of the data has been performed by NASA's Lewis Research Center. Results of the work are presented and recommendations for further measurements and for modifications to the measurement equipment and methods have been identified. Author

N69-18706# Société Anonyme de Télécommunications, Paris (France).
DATA TRANSMISSION AND HANDLING. FM/FM TELEMETRY [TRANSMISSION ET TRAITEMENT DES INFORMATIONS. LES TELEMESURES FM/FM]
M. Grenèche and M. Boissinot Mar. 1968 35 p In FRENCH
Presented at the CNES Symp. on Space Technol., Bretigny, France, 12 Mar.–2 Apr. 1968
Avail: CFSTI

Theoretical aspects are included in these lectures on the basic principles of FM/FM telemetry. International standards defining the characteristics of operational systems are also reviewed. ESRO

N69-18742# Signals Research and Development Establishment, Christchurch (England).
COMPOUNDED DELTA SIGMA MODULATION SYSTEM
R. M. Wilkinson Jul. 36 p
(SRDE-68012) Avail: CFSTI

A hardware model of a speech coder is described, based on the principles of the G.E.C. Mk. 3 compounded delta sigma modulator. Syllabic compression and expansion are incorporated in the system by using a pulse height modulator in the feedback path of the coder and a similar pulse height modulator at the decoder. The signal which controls the expansion at the decoder is implicit in the digital transmission from coder to decoder. The circuitry has been constructed using digital and linear integrated circuits and some discrete components. The necessary audio filters are included in the equipment in active filter form. Author (ESRO)

N69-18743# Signals Research and Development Establishment, Christchurch (England).
ELIMINATING THE EFFECT OF SITE REFLECTIONS ON RADIATION PATTERNS OF MICROWAVE AERIALS
T. K. Fitzsimons Jul. 1968 8 p refs
(SRDE-68016) Avail: CFSTI

A method for revealing the effect of site reflections on aerial radiation pattern measurements is described. The method can be used to identify the source of the reflections and also to eliminate their effects. Author (ESRO)

N69-18752# Weapons Research Establishment, Salisbury (Australia). Dept. of Supply.
TELEMETRY SYSTEMS AT RANGE 'E' WOOMERA
J. S. Bell Jul. 1968 29 p refs
(WRE-TN-TRD-26) Avail: CFSTI

A review, with brief descriptions, of the telemetry systems used at Range 'E', Woomera is given. Detailed information on the main characteristics of the systems is provided in a number of appendices. Author (ESRO)

N69-18760# Centre National d'Etudes Spatiales, Brétigny-sur-Orge (France). Div. Equipement du C.S.G.
RADIOELECTRIC EQUIPMENT FOR BALLOON SOUNDING [EQUIPMENTS RADIOELECTRIQUES POUR BALLONS-SONDES]
J. Beaucher 1 Apr. 1968 64 p In FRENCH Presented at the CNES Symp. on Space Technol., Brétigny, France, 12 Mar.–2 Apr. 1968
Avail: CFSTI

Description and characteristics of a new radio communication package designed by the CNES for high altitude balloons, able to perform the three functions: telemetry, command and localization. Onboard as well as ground support equipment are discussed. ESRO

N69-18802# Royal Aircraft Establishment, Farnborough (England).
THE DETERMINATION OF MULTI-PATH TIME DELAY ON RADIO LINKS BETWEEN A SYNCHRONOUS SATELLITE AND AN AIRCRAFT
G. May Jul. 1968 14 p refs
(RAE-TR-68192) Avail: CFSTI

An expression is developed for the difference in transmission times for the direct and earth reflected radio signals between a satellite and an aircraft. A nomogram and a set of graphs enable the time-delay to be obtained for aircraft flying at heights up to 100,000 feet within the service area of an equatorial synchronous satellite. Author (ESRO)

N69-18812# Société Intertechnique, Plaisir (France).
THE ADVANTAGES OF HAVING AN ON-BOARD COMPUTER INCLUDED IN A PCM TELEMETRY SYSTEM [INTERET D'UN CALCULATEUR DANS UN SYSTEME DE TELEMESURE PCM EMBARQUE]

M. Renaud Dec. 1968 12 p In FRENCH Presented at the CNES Intern. Colloq. on Computers aboard Rockets and Satellites, Paris, 3–6 Dec. 1968
Avail: CFSTI

The disadvantages and limits of PCM telemetry systems are recalled and the use of onboard computers as a means of improving them is discussed. The cases where the computer only receives orders to change the programs or is also used to compress data are considered. It is shown that standard computers with different programs are required so that the needs of many experiments can be accommodated. ESRO

N69-18818# Centre National d'Etudes Spatiales, Bretigny-sur-Orge (France). Div. Ballons.
COMMAND, TELEMETRY AND POSITIONING EQUIPMENT FOR BALLOONS. H.F. GONDOLA FOR LONG-LIFE BALLOONS [EQUIPEMENTS DE TELEMESURE, TELECOMMANDE ET LOCALISATION POUR BALLONS. NACELLE H.F. POUR BALLONS LONGUE DUREE]
G. Delmas 1968 11 p In FRENCH Presented at the CNES Symp. on Space Technol., Bretigny, France, 12 Mar.–2 Apr. 1968
Avail: CFSTI

The CNES is designing a double package for the Eole project and other long life balloons, consisting of an FM/FM telemetry system and an PCM telemetry system along with guidance and control equipment. The elements of these systems are discussed and their characteristics are indicated. Author (ESRO)

N69-18850# Centre National d'Etudes Spatiales, Bretigny-sur-Orge (France).
DEVELOPMENT OF A MODULATION PROGRAM. INTERMODULATION IN A TELEMETRY SYSTEM USING IRIG STANDARDS. TAPE PROCESSING [ELABORATION D'UN PROGRAMME DE MODULATION. INTERMODULATION DANS UN SYSTEME DE TELEMESURE ANALOGUE AU STANDARD IRIG. TRAITEMENT DE BANDES]
[1968] 46 p In FRENCH Presented at the CNES Symp. on Space Technol., Bretigny, France, 12 Mar.–2 Apr. 1968
Avail: CFSTI

In this laboratory course for students the principles of telemetry are stated along with the equations for FM and PM coding and decoding. A calibration program for receivers using IRIG standards is carried out by the students who then study intermodulation of the different frequencies in an analog telemetry system. The different ways of processing magnetic tape data are described and the students then compensate for wow and flutter. ESRO

N69-18882*# Kansas Univ., Lawrence. Engineering Science Div.
A STUDY OF HIGH PERFORMANCE ANTENNA SYSTEMS FOR DEEP SPACE COMMUNICATION Status Report, Feb. 15–Nov. 15, 1968
Nov. 1968 100 p refs Prepared in cooperation with Ohio State Univ.
(Grant NGR-17-004-013)
(NASA-CR-100024) Avail: CFSTI CSCL 17B

Considered were fundamental and pragmatic effects which will influence the performance of antenna systems for deep space communication. Ground based antennas were discussed for their down link aspects at carrier frequency of 2.3 GHz for information rates of the order 10^4 to 10^7 bits/second. Emphasis was placed primarily on the effects of signal bandwidth, array distortion, transient response, and various bandwidth characteristics of the pattern and antenna impedance for array antennas. G.G.

N69-18940# Comissao Nacional de Atividades Espaciais, San Jose dos Campos (Brazil). Conselho Nacional de Pesquisas.
A LASER RADAR FOR ATMOSPHERIC STUDIES
B. R. Clemesha Jan. 1969 38 p refs
(LAFE-83) Avail: CFSTI

This report describes the Miro II project, and in particular the instrumentation which is being constructed. The basic principles of the laser radar are explained, and the theory of atmospheric density measurements using such a radar is derived. The project Miro II radar is described, including its expected performance and a discussion of the requirements for atmospheric density measurements. A discussion of the possible further applications and developments of the project is also presented. Author

N69-19018*# Radio Corp. of America, Moorestown, N. J. Missile and Surface Div.
FEASIBILITY STUDY FOR A 60-GHz RADIOMETRIC ARRAY
Leonard H. Yorinks Jan. 1969 48 p refs
(Contract NAS12-149)
(NASA-CR-86121) Avail: CFSTI CSCL 09F

A novel very low sidelobe array of H-plane sectoral-horn radiating elements excited by a completely constrained optical power combiner has been shown to be feasible for radiometric service at a frequency of 16 GHz. The adaptation of this array concept to operation at 60 GHz and the feasibility of such a 60 GHz radiometer array is described. The 60 GHz array dimensions are derived from the 16 GHz design. The progress of latching ferrite phase shifters operating at 60 GHz is discussed and present developmental efforts are indicated. Array performance considering the effects of random and systematic errors is predicted based on a statistical analysis and on patterns computed including the effects of errors. Finally, some fabrication techniques are discussed to point out some of the possible construction problems associated with such a 60 GHz array. Author

N69-19025*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FEASIBILITY STUDIES OF DIRECT VOICE BROADCAST SATELLITES
Perry W. Kuhns Washington Feb. 1969 22 p refs
(NASA-TM-X-1747) Avail: CFSTI CSCL 17B

The results of two voice broadcast satellite studies undertaken in 1966–67 are summarized. These studies included audience and receiver analyses, conceptual spacecraft configurations, technological evaluations, cost evaluations, and data of indigenous noise surveys. Author

N69-19114*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE ADMITTANCE OF A PARALLEL-PLATE APERTURE ILLUMINATING A DISPLACED DIELECTRIC–DIELECTRIC BOUNDARY
J. Earl Jones Washington Feb. 1969 60 p refs
(NASA-TN-D-5038) Avail: CFSTI CSCL 09F

The variational method is used to determine the admittance of a transverse-electromagnetic-mode excited, parallel-plate aperture having an infinite flange and illuminating a displaced dielectric–dielectric boundary. The results are applied to provide insight into two problems of interest: (a) the effect of an air gap on the admittance of dielectric coated aperture antennas and (b) the admittance of an aperture antenna coated with an underdense plasma slab. Numerical computations for the air gap problem are verified experimentally. For either problem, the most significant changes in the admittance occur for displacements less than 0.25

wavelength. (The wavelength referred to is the free space wavelength divided by the square root of the relative permittivity of the medium between the boundary and the aperture.) For the dielectric coated slot antenna, changes in the admittance due to an air gap are enhanced if either the slot width is reduced or the permittivity is increased. For a slot antenna coated with a thin underdense plasma slab, the admittance becomes more sensitive to changes in the layer thickness as the plasma becomes more dense. As observed theoretically for both the air gap problem and the underdense-plasma problem, the admittance is not influenced by the presence of surface waves. Experimental verification of this result is given for the air gap problem. Author

N69-19225*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CONCATENATED CODING FOR SPACE COMMUNICATIONS
W. Miller, R. Muller, and J. Yagelowich Aug. 1968 21 p refs
(NASA-TM-X-63467; X-562-68-340) Avail: CFSTI CSCL 17B

A concatenated coding scheme is described which combines bi-orthogonal and parity coding. Results indicated that a substantial power gain of 6 1/2 decibels over uncoded pulse code modulation is achieved. Experimental results indicate that this coding scheme will permit operation at signal to noise ratios of two decibels or greater. Another important feature of this concatenated code is its simplicity of implementation. With presently available low power microcircuits, the estimated total power consumption for the code generator is 100 milliwatts. The detection operation can be performed in real time. Author

N69-19299# France. Ministere de l'Air, Paris.
STUDY OF A LARGE BAND, AERIAL DIRECTIVE SYSTEM IN THE TEN METER RANGE [ETUDE D'UN SYSTEME D'AERIENS DIRECTIF, LARGE BANDE, DANS LA GAMME DECAMETRIQUE]
Michael Crochet (Caen Univ.) 1968 74 p refs In FRENCH
(NT-161) Avail: CFSTI

A study is made of an antenna system used for investigation of the ionosphere by a retrodiffusion method. Biconical elements grouped in an array to meet the requirements of band size and directivity in the 10-meter range can be fed by a system of commutable lines which permit rotation of the lobe. The sun, on one hand, and a reflecting screen on the other, greatly alter the radiation patterns. Transl. by P.A.B.

N69-19346# Kaman Aircraft Corp., Colorado Springs, Colo. Nuclear Div.
AIRCRAFT VHF ANTENNA FOR SATELLITE COMMUNICATIONS TESTS Final Report
B. J. Bittner Jul. 1968 76 p refs
(Contract FA-67-WA-1632)
(AD-678954; RN-68-732(FR); FAA-RD-68-32) Avail: CFSTI

The research and design of a semi-flush type of VHF, transmitting and receiving antenna array is reported. The circularly polarized array is electronically steerable to four quadrants, overhead plus two optional, orthogonal, plane polarized, broad beam modes. VSWR and Pattern characteristics are included plus data on hardware details and installation techniques. To assist in the evaluation of the ATS-B satellite, and future ATS systems an FAA C-135 (N-98) flight-check jet was specially equipped with C-DD Antennas. A special, high gain VHF antenna array for use on the C-135 was developed. The antenna array consists of 6 nine element, essentially flush mounted system of C-DD antennas which provide selectable high-gain VHF beams, allowing the aircraft to track the ATS. The C-DD antennas are a recent invention and in this adaptation result in high efficiency, tunable, VHF antennas that project less than 3.4 centimeters from the aircraft surface in streamlined covers. Author (TAB)

N69-19434*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TELECOMMUNICATIONS DIVISION
In its Space Programs Sum. No. 37-54, Vol. 3, Oct.-Nov. 1968 31 Dec. 1968 p 171-229 refs (See N69-19427 08-34)
Avail: CFSTI CSCL 17B

Results of continuing research are reported, including analysis of short constraint length convolutional codes and the statistical dynamics of the phase error process in second order phase locked loops. Models for determining the allocation length of power between the carrier and information bearing portion of a transmitted signal, as related to rapidly varying phase error, were also constructed. Reports of rapidly pulsating radio stars at regular intervals led to studies of their usefulness in determining absolute time among the Deep Space Network stations. Research projects were conducted on 90 GhZ space communication systems, the power handling capacity of S band sterilizable high impact antennas, and radiation from a horizontal electric dipole antenna located in a cylindrically stratified plasma. Spacecraft telemetry and command work was centered on approximate analysis of channel imbalance effects in non-coherent frequency shift keyed receivers with large BT products, and spacecraft radio research involved low data rate telemetry RF systems development. A photon actuated solid state switch for application to the Mariner telecommunication system is also described. A.C.R.

N69-19488# National Research Council of Canada, Ottawa (Ontario).
INFLUENCING SULPHUR ACTIVITY IN CARBON-SATURATED HOT METAL BY ADDING MANGANESE, PHOSPHORUS OR CHROMIUM
H. Schenck et al 1968 10 p refs Transl. into ENGLISH from Arch. Eisenhuettenw. (Duesseldorf), v. 37, no. 7, 1966 p 541-543
(NRC-TT-1344) Avail: CFSTI

An investigation of the effect of manganese, phosphorus, or chromium on the activity of sulphur dissolved in molten iron saturated with carbon is presented. The vapours generated by metallic lead-sulphur solutions were allowed to establish equilibrium with several simultaneously present iron solutions. Thus these lead-sulphur solutions were used as the auxiliary phase of given sulphur activity. The presence of the additional alloying element is revealed by the fact that the sulphur concentration varies with the change in activity caused by the alloying element. Since the iron melts were in graphite crucibles, the influence on the activity is obtained for the case of the iron solution saturated with carbon. The temperature applied was 1550°C. The activity coefficient of the alloying element X on the sulphur activity is obtained. Author

N69-19515# Oulu Univ. (Finland). Dept. of Electrical Engineering.
CURVES FOR THE REFLECTION OF RADIO WAVES FROM AURORAL IONIZATION
J. Oksman 1968 13 p refs
(S-1) Avail: CFSTI

Curves of constant values of the propagation angle in geographic coordinates are given for some representative places in Finland. These curves were used to determine the optimum location of auroral ionization for reflections in the radar and in the bistatic case. Some examples of the latter are given, leading to a proposed measurement program. Author

N69-19520# TRW Systems, Redondo Beach, Calif.
EXPERIMENTAL PREDICTION OF BIT ERROR IMPROVEMENT IN ATMOSPHERIC NOISE FOR SYSTEM APPLICATIONS
W. B. Sisco and E. N. Bobrow 10 Jan. 1968 13 p refs
(TRW-99900-6471-T000) Avail: CFSTI

Experimental data have shown that it is possible to improve the bit error rates of a coherent phase shift keying system operating in atmospheric noise by use of a peak limiter. This report is concerned with an extension of the experimental results in order to arrive at more quantitative conclusions as to the degree of improvement obtainable by use of a peak limiter in various types of atmospheric noise. Samples of atmospheric noise statistics and measured bit error improvement factors are analyzed for dependence on location, frequency, season, time block, and bandwidth. The effects of bit rate or the time of one bit on limiter improvement is examined. The data indicate that it is possible to predict the reduction in effective noise level or bit error rate improvement by use of a peak limiter in a coherent phase detection system.
K.W.

N69-19548*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PLACE EXPERIMENT DESCRIPTION
Charles R. Laughlin, Roger C. Hollenbaugh, and Walter K. Allen Nov. 1967 27 p refs
(NASA-TM-X-63289; X-733-67-577) Avail: CFSTI CSCL 09F

This study was specifically directed toward an investigation of the dual aspects of communications and navigation as they relate to the existing and projected air traffic control requirements. The primary value of this preliminary study is that it points out that, from the engineering point of view, adequate technology already exists to meet the presently envisioned operational requirements of the mid 1970's. Of course, additional study and considerable experimentation is required to develop an economically justifiable and operationally tractable system. The following proposal is based on utilizing the ATS-F satellite and is scheduled to coincide with a launch in the early part of 1972. Development of an L-band repeater and an associated antenna compatible with the ATS-F spacecraft will be required. The existing Rosman and Mojave ATS ground stations must be outfitted with appropriate L-band feeds, receivers, and transmitters. The existing OPLE ground station will be modified and incorporated into the GSFC experimental facility to permit investigation of continuous and timeshared aircraft position location and tracking using both the now operational Omega network and independent VLF ground transmitters. Author

N69-19558#
UTILIZATION OF MATCHED FILTERS IN CIRCUITS FOR OPTIMAL RECEPTION OF RANDOM PHASE SIGNALS. ESTIMATE OF INFLUENCE OF PHASE RANDOMNESS
V. B. Pestriakov [1968] 8 p Transl. into ENGLISH from the book "Fazovye Radiotekhnicheskie Sistemy" Moscow, Sov. Radio Press, 1968 p 273-283
Avail: CFSTI

The possibilities of replacing a two channel correlator with a matched filter are discussed. A matched filter has the peculiarity that it is analogous to a correlator at the time corresponding to termination of signal action, and therefore, the quantity at its output is also expressed by a correlation integral. The operation of diagrams with correlators and with matched filters is compared in the reception of a signal with random phase. Their main difference is that a diagram with a correlator calculates one point of the signal autocorrelation function, and the matched filter reproduces the whole autocorrelation function in a real time scale at its output.
B.P.

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N69-18588*# Bellcomm, Inc., Washington, D.C.
TRENDS IN THE DESIGN OF AEROSPACE DIGITAL COMPUTERS
Donald O. Baechler [1968] 9 p Presented at the CNES Intern. Colloq. on Computers aboard Rockets and Satellites, Paris, 3-6 Dec. 1968
(NASw-417)
(NASA-CR-99970) Avail: CFSTI

Aerospace digital computers are becoming more like ground-based computer systems. This is indicated by trends toward faster speeds, multiple format instructions, parallel arithmetic, floating point number representation, a large instruction set, longer word length, and more sophisticated software. The use of large scale integration (LSI) techniques will accelerate these trends. Reliability continues to be a primary consideration in aerospace computer design. Triple modular redundancy is one technique that has been used to increase reliability. A similar technique, a triplicated interface element proposed by the author, is described in the appendix. Some other techniques that might be used are multiprocessors, arithmetic codes and, in manned missions, inflight maintenance.
Author (ESRO)

N69-18598# Ferranti Ltd., Bracknell (England). Digital Systems Dept.
AN OUTLINE OF THE FERRANTI DATA HANDLING SYSTEM PROPOSED BY THE SUD-AVIATION GROUP FOR PROJECT L.A.S.
J. E. Remmington, R. A. Williams, and R. E. Wright [1968] 50 p Presented at the CNES Intern. Colloq. on Computers aboard Rockets and Satellites, Paris, 3-6 Dec. 1968
Avail: CFSTI

In 1967 Sud-Aviation formed a group of companies to tender for the E.S.R.O. requirement for a Large Astronomical Satellite (L.A.S.). Ferranti Limited has given the responsibility for designing the data handling system. The general requirements for the spacecraft and its data handling system are reviewed and the solutions proposed and the reasons for choosing them are described. In particular the method of organizing the data handling system to overcome equipment failures is described and also the design of the computer together with its interfaces and the programming strategy adopted. The predicted performance of the system is discussed. Although the L.A.S. project was not continued, the computer design proposed has since been used as the basis of a new computer, the FM1200, intended for aerospace applications. This computer is described briefly with reference to those features which were derived from the L.A.S. machine. Author (ESRO)

N69-18699*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIGITAL PRE-FILTERED ADAPTIVE DELTA MODULATION APPLICATION TO MAGNETIC FIELD EXPERIMENT
Charles V. Moyer Dec. 1968 38 p refs
(NASA-TM-X-63452; X-616-68-455) Avail: CFSTI CSCL 09B

Details are given on a digital high pass filter and an adaptive delta modulator to be used for on-board data compaction of satellite-acquired magnetic field data. The high pass digital filter removes the spin modulation from the magnetic field data. The adaptive delta modulator provides a four to one bit rate reduction compared to straight PCM encoding. A feasibility model of the filter and adaptive delta modulator working in conjunction was built and tested. Author

N69-18714# Centre National d'Etudes Spatiales, Paris (France).
SIMULATION OF ROSEAU COMPUTER [SIMULATION DU CALCULATEUR ROSEAU]
Jean Cazemajou 1968 7 p In FRENCH Presented at the CNES Intern. Colloq. on Computers aboard Rockets and Satellites, Paris, 3-6 Dec. 1968
Avail: CFSTI

A computer is being designed for the Franco-Russian satellite ROSEAU. A program has been written for an IBM 360-65 computer to simulate its operation and it will be used in designing both the hardware and the software. Some conclusions have already been drawn e.g. Fortran is unsuitable for such a program; the simulation need not be fine; the simulating program should not be written before the design of the simulated computer has come to a fairly advanced stage, the simulating program must be updated as the simulated computer is being modified. ESRO

N69-18749 Washington Univ., Seattle.
CONTEXT-FREE LANGUAGES AND MARKING AUTOMATA
Fred Neil Springsteel (Ph.D. Thesis) 1967 134 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-9333

A language is any subset of the free semi-group of words over a finite set of symbols, called the alphabet of the language. Certain languages can be generated by context-free (CF) grammars which are accepted by push-down automata (PDA) by halting in a favorable state if the input is in the language. Moreover, they are known to be closed under (semi-group) homomorphisms on their alphabets. A marking automaton (MA) can be thought of as a two-way finite control machine which cannot extend its tape or even change it except to attach reference markers from a fixed finite supply. Using the notion of acceptance of a language by an MA and introducing into it the idea of non-determinism, it is shown that any CF language can be accepted by some MA. The path starts with the observation that standard CF languages can be recognized by deterministic MA; and through a series of increasingly specific normalizations of deterministic MA, it is shown that, if the hemomorphism is .\-free, such an image is an MA language. The rest of the main result is supplied with the help of standard operator form rules for a CF grammar, a counter-part to real-time PDA with restricted control. Dissert. Abstr.

N69-18774# Laboratoire Central de Télécommunications, Paris (France).
SPACECRAFT COMPUTERS. APPLICATION TO SATELLITES [CALCULATEU POUR ENGINS. APPLICATIONS AUX SATELLITES]
G. Yelloz [1968] 25 p In FRENCH Presented at the CNES Intern. Colloq. on Computers aboard Rockets and Satellites, Paris, 3-6 Dec. 1968
Avail: CFSTI

Two microminiaturized digital computers designed for spacecraft and aeroplanes are described. One of them, the 825 P is a 4000 words 25 bits computer, the other one, the CS 2 is a 1000 words 16 bits computer. After a detailed review of the characteristics of these computers, the technique utilized in producing the storage devices as well as the logic circuits are described. The problem of spacecraft computers is discussed and an adaptation of the CS 2 computer as a space-borne computer is presented. Author (ESRO)

N69-18787# Société pour l'Etude et la Réalisation d'Engins Balistiques, Courbevoie (France). Direction Technique.
ANALOGIES AND DIFFERENCES BETWEEN LAUNCH VEHICLE-BORNE AND SATELLITE-BORNE COMPUTERS [ANALOGIES ET DIFFERENCES ENTRE CALCULATEURS EMBARQUES SUR LANCEURS ET SUR SATELLITES]
G. Collot 29 Nov. 1968 11 p In FRENCH Presented at the CNES Intern. Colloq. on Computers aboard Rockets and Satellites, Paris, 3-6 Dec. 1968
Avail: CFSTI

The characteristics of the first and second generation computers used on launch vehicles are analyzed. The first generation computers were only concerned with guidance whereas the second generation ones also perform some calculations even after the ballistic phase is over. Third generation computers which, in addition, would reduce data are also considered. The main difference between the first and second computers lies in their reliability as the life of satellite-borne ones must be longer than the life of one in a launch vehicle. ESRO

N69-18824# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
DESIGN AND FABRICATION OF A WIRE MAGNETIC STORAGE DEVICE [ET UDE ET REALISATION D'UNE MEMOIRE A FILS SPATIALE]
L. Chabanas, G. Antier, G. Grunberg, G. Nicolas, and I. Melnick 26 Nov. 1968 18 p In FRENCH Presented at the CNES Intern. Colloq. on Computers aboard Rockets and Satellites, Paris, 3-6 Dec. 1968
Avail: CFSTI

A magnetic storage device composed of a series of horizontal wires with each bit of a word being stored vertically on a different wire is described. Different configurations are discussed and temperature effects and range of operation are discussed. ESRO

N69-18827# Centre National de la Recherche Scientifique, Grenoble (France). Inst. de Matho-matiques Appliquées.
DATA HANDLING SYSTEM IN CASSANDRE LANGUAGE. APPLICATION TO SIMULATIONS [SYSTEME DE TRAITEMENT DES DESCRIPTIONS EN LANGAGE CASSANDRE. APPLICATION A LA SIMULATION]
F. Anceau and P. Liddell [1968] 12 p refs In FRENCH Presented at the CNES Intern. Colloq. on Computers aboard Rockets and Satellites, Paris, 3-6 Dec. 1968
Avail: CFSTI

The system presented is destined to emphazise the qualities of the properties of the language CASSANDRE and to furnish an interesting tool for simulation and synthesis applications as well as for research on the processing and uses of the language. In view of this goal, the processing operations have been fractioned and use of incremental compilation, by automatic generation of modules linked to the language syntax, allows slight modifications of this latter. The system is composed of a set of programs, common to all uses, destined to code, verify and put the source text in a library; specialized programs contain incremental analysers provided with appropriate semantic functions. Simulation employs a multipassage algorithm designed to permit calculation of any expression, regardless of its interdependence, under certain synchronization conditions, by separating the anterior values from the posterior values of memorization elements. Synthesis produces a progressive refinement of description by the creation of embedded virtual sub-units. Other uses of this language can be considered. Author (ESRO)

N69-18886* Space and Tactical Systems Corp., Burlington, Mass.
PCM ENCODER SYSTEM Final Report
31 Jan. 1969 87 p
(Contract NAS9-8380)
(NASA-CR-99513) Avail: CFSTI CSCL 09B

Discussed in detail is the total configuration of the PCM encoder system with flexible frame format, frame size, and sample rate. A master programmer provides all necessary control functions to convert and time multiplex all incoming data into a serial bit stream capable of driving a transmitter. It incorporates clock countdown, parallel-to-serial output register, and a 16-channel multiplexer. A logic diagram of the master programmer is included. G.G.

N69-18954*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A CONVERSATIONAL APPROACH TO MATRIX CALCULATIONS. CONCEPTS AND IMPLEMENTATION

R. Bruce Canright, Jr. Washington Feb. 1969 42 p refs

(NASA-TM-X-1749) Avail: CFSTI CSCL 09B

The conversational use of computers makes user-oriented languages desirable. A computer program was developed which enables users to do matrix calculations conversationally, without knowledge of computers or programming languages. The program converses in a brief command language, which provides for input/output, matrix arithmetic, forming of the transpose, inverse, determinant, and eigenvalues, and exponentiation. Details of the program language and logic are given, with a sample user program conversation. Technical details and FORTRAN program listings are also presented. Author

N69-18999*# Notre Dame Univ., Ind. Dept. of Electrical Engineering.

CONVOLUTIONAL CODING TECHNIQUES FOR DATA PROTECTION Final Report, 16 Sep. 1967–15 Sep. 1968

James L. Massey 3 Feb. 1969 8 p refs

(Grant NGL-15-004-026)

(NASA-CR-100185) Avail: CFSTI CSCL 09D

The principal results obtained were the following: (1) easily programmable algorithms for the synthesis of good, long convolutional codes; (2) a unified analysis of decoders for convolutional codes based on the use of stochastic sequential machines models; (3) demonstration of the existence of "good" classes of convolutional codes with "bad" error propagation properties; (4) development of necessary and sufficient conditions for linear sequential machines to have feedforward inverses; (5) development of a simple conceptual approach to obtain the properties of the Fano sequential decoding algorithm; (6) new bounds on minimum distance for convolutional codes; (7) development of a complete and unified theory for inverses of linear, time-invariant dynamical systems; and (8) further development and simplification betwsen decoding procedures for the Bose-Chaudhuri-Hocquenghem codes and the synthesis of minimal length linear feedback shift-registers. Author

N69-19078# Lockheed Missiles and Space Co., Palo Alto, Calif. Electronic Sciences Lab.

CORRELATING REMOTE SENSOR SIGNALS WITH GROUND-TRUTH INFORMATION

Walter G. Eppler and Roy D. Merrill Nov. 1968 69 p refs

(LMSC-6-79-68-8) Avail: Issuing Activity

Two computer-based methods are described for data handling and display which significantly simplify the task of correlating remote sensor signals with ground truth information. These techniques were applied successfully to microwave radiometer and infrared spectrometer flight test data. Results indicate that the digital computer, with its associated storage and display capabilities, makes possible systematic and accurate analysis of remote sensor data at low cost. In one approach, the computer is used to determine and display the exact path of the sensor boresight over the ground scene. Using this display, an investigator can observe visually certain simple correlations between the sensor return and the ground scene. In the second approach, the analyst uses a special light pen console to put ground truth information (in graphical form) into the computer. Using techniques described here for storing, retrieving, and processing graphical data, the computer automatically converts the ground truth information into a form where it can be correlated directly with the remote sensor signals. Author

N69-19106# Grenoble Univ. (France). Lab. de Calcul.

DESCRIPTION OF A COMPUTER LANGUAGE ORIENTED TOWARDS THE HARDWARE CASSANDRE [DESCRIPTION FORMELLE D UN LANGAGE ORIENT VERS LE HARDWARE CASSANDRE]

J. Mermet [1968] 42 p refs In FRENCH Presented at the CNES Intern. Colloq. on Computers aboard Rockets and Satellites, Paris, 3–6 Dec. 1968

Avail: CFSTI

The different phases of the digital systems project call upon an important number of diverse exercises and specialists. The automation of these phases and of their development evidently involves the elaboration of a 'common language', common to all the conceptors. Such a language also appears to be one of the most convenient tools for use in teaching machine structure and conception. According to the nature of the processing a description undergoes, this one and same description can take on different interpretations and applications. For this, one must solve the difficult problem of semantic ambiguities and distinguish the descriptive levels. The language syntax must exactly reflect the nature of the objects described and allow construction of a flexible, powerful and conversational set of processing programs. Author (ESRO)

N69-19172*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE SDP-3, A COMPUTER FOR USE ON BOARD SMALL SCIENTIFIC SPACECRAFT

R. A. Cliff [1968] 7 p Presented at the CNES Intern. Colloq. on Computers aboard Rockets and Satellites, Paris, 3–6 Dec. 1968

(NASA-TM-X-61451) Avail: CFSTI CSCL 09B

The SDP-3 is a general-purpose stored-program computer which has been designed for use as the core of the data system of a small scientific spacecraft. It is a serial, two's complement, 16 bit word machine. It has one level of indirect addressing and one hardware index register. To facilitate time-sharing operation there is a 16-level priority interrupt system and a real time clock. The 4K memory is divided into 16 pages of 256 words each. There is a user and a monitor mode. Interpage access is prohibited in user mode. Author (ESRO)

N69-19188*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ONBOARD PROCESSOR: PHILOSOPHY, DESIGN, AND OPERATION

Ronald M. Muller Feb. 1969 14 p refs Presented at the CNES Intern. Conf. on Aerospace Computers in Rockets and Spacecraft, Paris, Dec. 1968

(NASA-TM-X-63472; X-562-69-65) Avail: CFSTI CSCL 09B

The onboard processor (OBP) is a general-purpose stored-program spacecraft computer designed to play a central role in a spacecraft's operation, control, and data-handling. Standardized electronics allow it to take on the many configurations needed for a variety of missions without the expense of developing specialized electronics. Its programs use an English-like assembly language to facilitate program writing. Operation of the OBP in orbit presents new problems to the ground system; the design of the flight electronics and programs attempts to minimize this impact. Author

N69-19226*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
THE SDP-3—A COMPUTER DESIGNED FOR DATA SYSTEMS OF SMALL SCIENTIFIC SPACECRAFT
Rodger A. Cliff Feb. 1969 22 p ref
(NASA-TM-X-63470; X-711-69-43) Avail: CFSTI CSCL 09B

The SDP-3 is a general purpose stored program computer which has been designed for use as the core of the data system of a small scientific spacecraft. It is a serial, two's complement, 16 bit word machine. It has one level of indirect addressing and one hardware index register. To facilitate time sharing operation there is a 16 level priority interrupt system and a real time clock. The 4K memory is divided into 16 pages of 256 words each. There is a user and a monitor mode. Interpage access is prohibited in user mode. Author

N69-19270# Los Alamos Scientific Lab., N. Mex.
THE LAPLACE FORTRAN CODE
John Knox Hayes 31 Oct. 1968 20 p refs
(Contract W-7405-ENG-36)
(LA-4004) Avail: CFSTI

The subrouting LAPLACE used to obtain a numerical approximation to a solution of Laplace's equation is described. LAPLACE is written in FORTRAN for the CDC 6600. NSA

N69-19343*# Lockheed Electronics Co., Houston, Tex. Systems Engineering Section.
INTERFACE STUDY REPORT, DRC 3200-1108
F. E. Mc Kee 26 Nov. 1968 11 p
(Contract NAS9-5191)
(NASA-CR-99532; Rept-537012) Avail: CFSTI CSCL 09B

The requirements for the transmission of data from the CDC 3200 computers (I/O and telemetry computers) to the UNIVAC 1108 computer located in a data reduction center are analyzed, and recommendations are made to satisfy the requirements. Four alternative solutions, each requiring a CDC 8275 switch and at least two additional CDC 3206 data channel controllers, are considered: (1) modification of the existing 3206-418 adapter; (2) modification of the existing CDC 3200-3800 satellite coupler; (3) procurement of an interface designed specifically for this purpose; and (4) leasing of the necessary computer terminal equipment to use the AT&T model 301-B highspeed (40.8 KBS) communication links. K.W.

N69-19375# Universidade do Porto, Oporto (Portugal). Observatorio Astronomico.
DIGITAL RECORDING OF THE CIRCLE AT THE OPORTO UNIVERSITY MIRROR TRANSIT CIRCLE
R. S. DeSousa Nunes and D. Appelt 1968 13 p refs
Avail: CFSTI

Improvements to the mirror transit circle are discussed with particular reference to its mechanical and data readout capabilities. The digitizing of the four micrometers is mentioned; each micrometer digitizer consists of a mechanical digitizer which accounts for the complete revolutions performed by the micrometer, and an optical digitizer which permits a resolution of one thousandth of revolution. Plans for circle digitizing are outlined, and a block diagram of the system is included. M.G.J.

N69-19391# Rochester Univ., N. Y. Nuclear Structure Research Lab.
DEVELOPMENTS IN ON-LINE DATA ACQUISITION
H. W. Fulbright Dec. 1968 22 p refs Presented at Meeting of APS, Miami, 1968 Supported in part by NSF
(UR-NSRL-8) Avail: Issuing Activity

Experiences gained in the use of on-line computer systems during the past few years reviewed, pointing out the most significant lessons learned and the economics involved. Considered is mainly the use of such systems in nuclear structure research laboratories. The work capacities of on-line computer systems as related to the size of the computer are outlined. Hardware, software, and operations of the large, time-shared systems in the tandem Van de Graaff accelerator laboratories at Yale University and at the University of Rochester are described and compared. Both systems were planned for nuclear research, operate with multi-programming monitor control, and on a low priority basis permit background calculations simultaneously with data acquisition. K.W.

N69-19511 National Lending Library for Science and Technology, Boston Spa (England).
ON THE USE OF CORRELATION FUNCTIONS IN OBJECTIVE ANALYSIS
E. M. Dobrysman et al [1968] 41 p refs Transl. into ENGLISH from Tr. Leningr. Gidrometeorol. Inst. (Leningrad), no. 1, 1967 p 134–164 In ENGLISH and RUSSIAN
(NLL-M-7468-(5828.4F) Avail: Natl. Lending Library, Boston Spa, Engl.

Some properties of autocorrelation functions are considered for random two-dimensional homogeneous and isotropic fields. Problems in the best use of data from stations in objective analysis are studied. Author

N69-19519# RAND Corp., Santa Monica, Calif. Computer Sciences Dept.
SOVIET CYBERNETICS: RECENT NEWS ITEMS, NO. 21
Dorothy McDonald, ed. Aug. 1968 120 p refs
(P-3600/21) Avail: Issuing Activity

This issue contains the following items: (1) newspaper articles on the Ruta-701 reading device, a computer center serving several factories, computer control of automobile production at a Moscow factory, and computers in animal husbandry; (2) a survey of data storage devices, automated design of computers, development of large computer systems, computers in physics research, and computer technology in construction; (3) computer center organization and data processing at the "Frezer" cutting tool plant, and the "Ritm" system for accounting and control of house-construction combines; (4) an article on the preparation and defense of dissertations for academic degrees; (5) automation of planning and control of the Ukrainian national economy, and game theory and optimization in space flight; (6) data processing systems in measuring technology; (7) news articles concerning the All-Union Congress on Psychology and on vacancies in mathematics and computer sciences at the Academy of Sciences; (8) the role of theory and cybernetics in military affairs; and (9) review of a book on production control, press review for August 1968, and several photographs of Soviet data processing equipment. K.W.

N69-19533 National Lending Library for Science and Technology, Boston Spa (England).
ON THE SYSTEM OF MECHANISED PROCESSING OF THE DATA OF THE OBSERVATIONS OF THE COMPLETE HYDROLOGICAL NETWORK OF THE GUGMS (MAIN OFFICE OF THE HYDROMETEOROLOGICAL SERVICE)
N. F. Dement'ev et al 1967 12 p ref Transl. into ENGLISH from Nauch. Issled. Inst. Aeroklim. (Moscow), no. 39, 1967 p 15–21
(NLL-M-7502-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

A computer based method for processing data from a network of Soviet hydrometeorological stations is described. The volume of the information to be processed is estimated at present to be over one million decimal characters per day which must be quickly

produced in a suitable form for use by both financial and scientific government organizations. The objectives of the new system are threefold: (1) to mechanize all links in the processing chain for primary hydrological data; (2) to organize an automatic method of searching, as well as processing, a great quantity of permanently preserved data; and (3) to initiate an automated system of preparing the data for printing. The proposed system involved the transcription of information from punched card to magnetic tape or microfilm and the feeding of the hydrological data into the computer from the various input devices using standard programs. Certain problems involved in the processing of hydrological information are also discussed. A.C.R.

N69-19550# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
COOLING OF HIGH-POWER-DENSITY COMPUTER COMPONENTS
A. E. Bergles, N. Bakhru, and J. W. Shires, Jr. Nov. 1968 143 p refs
(DSR-70712-60) Avail: Issuing Activity

A number of the heat-transfer characteristics of several fluorochemicals which have potential application as coolants for high power density computer components have been elucidated. Single-phase heat-transfer coefficients have been determined for Freon-113 and FC-78 flowing in a rectangular channel with one of the wide sides heated. Subcooled flow boiling data were taken with the rectangular channel for a wide variety of fluid-surface combinations, and over a wide range of flow conditions. Pool boiling tests indicated large temperature overshoots in the boiling curve with Freon-113. It was found that conventional correlations do not adequately describe critical heat flux data for horizontal circular heaters. The critical heat flux increases as diameter decreases, and increases as the wall thickness increases. The observed hysteresis effects in pool and flow boiling were examined in detail. Author

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N69-18506# Royal Aircraft Establishment, Farnborough (England).
AN ELECTRONIC METHOD FOR THE CONVERSION OF dc VOLTAGES TO THREE LINE SYNCHRO DRIVE SIGNALS
A. D. Brown Feb. 1968 42 p refs
(RAE-TR-68035) Avail: CFSTI

The report describes a compact electronic system which can convert any dc voltage typically within the range ±100 volts, into an equivalent three line ac synchro form, either 50 c/s or 400 c/s, with sufficient output power to drive four torque synchro receivers in parallel. Its application to the driving of both single and multi-turn flight simulator instruments is discussed together with an indication of the performance achieved. Brief circuit details are given in an appendix. Author (ESRO)

N69-18513# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MAGNETIC ELEMENTS IN COMPUTER ENGINEERING (SELECTED ARTICLES)
2 Apr. 1968 28 p refs Transl. into ENGLISH from Tr. Soveshch. Mono. Vesesoyuznoe Soveshch. Po Magnitn. Elementam Avtomat. i Vychislitelnoi Tekhn. (Moscow), 1966 p 44–56
Avail: CFSTI CSCL 9/2

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1. BUILDING LOGIC CIRCUITS FROM THIN FERROMAGNETIC FILMS WITH A CYLINDRICAL BACKING Yu. A. Popov et al p 1–7 refs (See N69-18514 08-09)

2. UNIFIED COMPLEX OF FERRITE-TRANSISTOR ELEMENTS FOR 200 kHz OPERATING FREQUENCY B. A. Yefimov et al p 8–19 refs (See N69-18515 08-09)

N69-18514# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BUILDING LOGIC CIRCUITS FROM THIN FERROMAGNETIC FILMS WITH A CYLINDRICAL BACKING
Yu. A. Popov et al *In its* Magnetic Elem. in Computer Eng. 2 Apr. 1968 p 1–7 refs (See N69-18513 08-09)
Avail: CFSTI

Thin film elements which require low power drive fields are analyzed. The films are deposited on cylindrical glass or metallic substratas with the easy and hard axes directed along the cylinder circumference and longitudinal cylinder axis, respectively. The authors describe how information may be entered and read-out from these thin film memory cells. This is accomplished by applying two crossed pulsed fields which may be derived from the output signals of adjacent cells. The output voltages of these elements are of the order of 100 mv. A number of memory cells may be placed on one cylindrical substrata. Thus, in a laboratory test 16 elements were deposited on metallic and glass substratas with outer diameters of 1–1.5 mm. The permalloy film thickness was of the order of 30,000 Å and output signals were 100–150 mv. The authors are of the opinion that these elements will find use in read-only memories, non-destructive readout stores, as well as in implementation of logic functions using thin films only. Author

N69-18515# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
UNIFIED COMPLEX OF FERRITE-TRANSISTOR ELEMENTS FOR 200 kHz OPERATING FREQUENCY
B. A. Yefimov et al *In its* Magnetic Elem. in Computer Eng. 2 Apr. 1968 p 8–19 refs (See N69-18513 08-09)
Avail: CFSTI

The FTE complex can be used to construct general-purpose, special-purpose and control computers, systems and devices of digital technology and digital automatics of general and special assignment. During development and testing of the following positive sides of selected direction of planning of the complex of elements were discovered: (1) sufficient manufacturability during reproduction under conditions of series production thanks to application of printed wiring and automation of manufacturing processes; (2) sufficient universality in connection with realization in complex of a majority of the above-mentioned requirements; and (3) selection of circuit solutions of elements of complex permitted developing FTE which operate in a wider temperature range (−50 to +60°). Deficiencies of the FTE complex are relatively increased dimensions of basic element FT-1 and a certain complexity of construction of pulse transformers. Author

N69-18691# Signals Research and Development Establishment, Christchurch (England).
COMPUTER AIDED LAYOUT OF MICROCIRCUITS
W. J. Cullyer, Sylvia Tubbs, and A. P. Stockton Sep. 1968 35 p refs
(SRDE-68014) Avail: CFSTI

To eliminate some of the skilled human effort in arranging the layout of the components of a microcircuit on a substrate, it is proposed that the process should be aided by a digital computer. A fully automated system does not seem possible at present. The method which has been suggested, and partially developed, relies on the automatic production of a rough layout which is unconstrained in size. This is then rearranged by human intervention, the designer communicating with the machine using a simple drawing language and viewing the progress of the work using an on-line graphical display. Author (ESRO)

N69-18761*# IIT Research Inst., Chicago, Ill. Thermal Measurement Section.

EVALUATION OF VACUUM UV DETECTOR-SPECTROSCOPY SYSTEMS FOR CAPSULE REENTRY MEASUREMENTS

Ronald L. Ohlhaber, Mark W. P. Cann and Harold V. Watts Washington NASA Feb. 1969 167 p refs

(Contract NAS1-7481)

(NASA-CR-1268; IITRI-V6045) Avail: CFSTI CSCL 20F

Various vacuum ultraviolet detector-spectroscopy systems that could be employed for spectroscopic measurement of the shock wave created ahead of a capsule experiencing hypervelocity reentry conditions were analyzed and evaluated. A generalized set of measurement requirements and environmental conditions was established for a 50,000 ft/sec entry velocity. These conditions are then used to evaluate such detector-spectroscopy systems as ion chambers, proportional counters, Geiger-Mueller tubes, photoelectric tubes, wavelength shifters, photoconductive cells, photovoltaic cells, reverse biased diodes, miniature photodiode arrays, and photoelectric cathode with retardation grid analyzers. The most favorable system appears to be a wavelength dispersing device (grating) followed by an electronically scanned miniature detector array. The array elements could be chosen from either photodiodes, phototransistors, or photoconductors, whichever shows the best vacuum ultraviolet response. Author

N69-18762*# Radio Corp. of America, Princeton, N. J. Microwave Applied Research Lab.

DEVELOPMENT OF HIGH POWER TRANSFERRED ELECTRON EFFECT DEVICES FOR X-BAND AND Ku-BAND OSCILLATORS

S. Yegna Narayan and A. R. Gobat Dec. 1968 26 p refs

(Contract NAS12-685)

(NASA-CR-86116) Avail: CFSTI CSCL 09A

Research program on cw transferred electron oscillators in X- and Ku-bands is described. Details of the material used, fabrication techniques, and characteristics of the oscillators delivered to the contracting agency are discussed. After analyzing the material and device technology available at the end of the contract, recommendation for further investigations are made. Author

N69-18768# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

R-C TRANSIENT SUPPRESSION UNITS [R-C BESCHALTUNGSEINHEITEN]

J. G. Bäumler and R. C. Kunze Jul. 1968 16 p refs In GERMAN; ENGLISH summary

(IPP-4/53) Avail: CFSTI

To damp overvoltages caused by reflections in unterminated coaxial systems, R-C-transient suppression circuits were developed. They consist of a concentrated capacitance and a resistor in series, which are both independent of voltage and frequency. Several types of these units from 10 nF and 2.6Ω to 130 nF and 1.05Ω have been built, all for a voltage of 55KV with an inductance less than 8 nH. Author (ESRO)

N69-18790# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).

SWITCHES FOR HIGH CURRENT DEVICES [SCHALTELEMENTE FUER STOSSSTROMANLAGEN]

R. Wilhelm Aug. 1968 33 p refs In GERMAN; ENGLISH summary

(IPP-1/85) Avail: CFSTI

This work reviews the properties of the several switches used in high current devices. In particular the air-pressured spark gaps, the ferrite-decoupled crowbar switches, and a solid dielectric foil switch are described which are in use at the fast θ-pinch experiment Isar IV. Author (ESRO)

N69-18875# Commissariat à l'Energie Atomique, Limeil (France). Div. Physique Générale.

BLOCKING OF PHOTOMULTIPLIER TUBES [BLOCAGE DE TUBES PHOTOMULTIPLICATEURS]

Jacques Andrivet Oct. 1968 19 p In FRENCH; ENGLISH summary

(CEA-R-3565) Avail: CFSTI

In some application, as for example flight time measurements, it is necessary to reduce the gain of photomultiplier tubes. A simple device is described which reduces the gain by a factor of up to $3.10E^2$ in 40 ns., the time required to return to initial gain being not greater than 40 ns. A standard pulse generator is used for the triggering. Author (ESRO)

N69-18881*# Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.

ANALYTICAL STUDY PROGRAM TO DEVELOP THE THEORETICAL DESIGN OF TRAVELING-WAVE TUBES Final Report

O. G. Sauseng, A. Basiulis, I. Tammaru 31 Oct. 1968 221 p refs

(Contract NAS3-9719)

(NASA-CR-72450; HAC-EDD-W-2646) Avail: CFSTI CSCL 09A

An analytical design study for a high efficiency traveling-wave tube amplifier for use in a satellite television transmitter is described. Several amplifier versions were evaluated with various frequency, power and modulation specifications. The design is based on the coupled cavity structure, which is dielectrically loaded and PPM focused for the 850 MHz and 2 GHz versions to reduce size and weight. The higher frequency versions are solenoid focused. A major emphasis of the studies is placed on achieving very high efficiency. The tube designs include therefore velocity resynchronization using the multiple voltage jump method as well as multistage collector depression, with predicted efficiencies in the range of 70 to 80%. The design of the tubes with amplitude modulation employs the novel grid modulator technique, which permits linear response over a large dynamic range with very high efficiency. The cooling system constitutes an integral part of the spacecraft using a combination of dielectric and one way heat pipes. Author

N69-18892 Iowa Univ., Iowa City.

APPLICATION OF SEQUENTIAL SWITCHING THEORY TO DIGITAL COMPUTER CONTROL

Donald Rae Stover (Ph.D. Thesis) 1968 96 p

Avail: Univ. Microfilms HC $5.00/Microfilm $3.00 Order No. 68-10696

In this study, a special type of sequential circuit, called a control sequencing circuit, is introduced as a model of typical digital computer control sequence requirements. A technique for state assignment of the control sequencing circuit based upon an assumed simple form for the circuit is developed. By considering constraints imposed by the form upon the state assignment, a

procedure is devised for obtaining a step-by-step design of a control sequencing circuit. The procedure is divided into two parts: the output logic design and the excitation logic design. By allowing more than the minimum number of internal state variables and forcing each output (or its complement) to be a conjunction of internal state variables, simplicity of the output logic is obtained. Extension of this approach to the excitation logic provides a solution to both the output and excitation design problems. Dissert. Abstr.

N69-18946*# Hughes Aircraft Co., Culver City, Calif. Research and Development Div.
STUDY OF IMPROVED PARTS CONTROL TECHNOLOGY FOR ADVANCED PLANETARY MISSIONS. VOLUME 1: SUMMARY
[1968] 19 p
(Contract NAS1-7259)
(NASA-CR-66742-1) Avail: CFSTI CSCL 14D

The purpose of the study was to develop methods for close management control and audit of an ultrahigh-reliability parts program by a prime contractor in an advanced space program. The control is to function effectively despite the problem of contractual delegation of responsibility from contractors to subcontractors. This volume contains a summary of study activities and objectives, a discussion of each of the end items, the conclusions, and recommendations for the implementation of the results. K.W.

N69-18947*# Hughes Aircraft Co., Culver City, Calif. Research and Development Div.
STUDY OF IMPROVED PARTS CONTROL TECHNOLOGY FOR ADVANCED PLANETARY MISSIONS. VOLUME 2: PART CONTROL PACKAGE
Feb. 1969 103 p
(Contract NAS1-7259)
(NASA-CR-66742-2) Avail: CFSTI CSCL 14D

A typical parts control package has been developed to test the practicality and effectiveness of this concept for the unified control over all phases of part usage. The typical package consists of general as well as detailed specifications for the control of part processing, procurement, application, selection, qualification, inspection, handling, and storage. A special long-life transistor serves as the typical part. K.W.

N69-18948*# Hughes Aircraft Co., Culver City, Calif. Research and Development Div.
STUDY OF IMPROVED PARTS CONTROL TECHNOLOGY FOR ADVANCED PLANETARY MISSIONS. VOLUME 3: TEXT OF PRPOSED CONTRACTUAL REQUIREMENTS
[1969] 5 p
(Contract NAS1-7259)
(NASA-CR-66742-3) Avail: CFSTI CSCL 14D

The results of the parts program are formulated into a text of proposed contractual requirements which NASA can use to implement effective parts control. The requirements are written for inclusion in a Statement of Work of an advanced planetary program and are to be imposed on the prime contractor. K.W.

N69-18949*# Hughes Aircraft Co., Culver City, Calif. Research and Development Div.
STUDY OF IMPROVED PARTS CONTROL TECHNOLOGY FOR ADVANCED PLANETARY MISSIONS. VOLUME 4: PARTS APPRAISAL
[1969] 82 p
(Contract NAS1-7259)
(NASA-CR-66742-4) Avail: CFSTI CSCL 14D

Five reliable part types (a transistor, a resistor, a capacitor, a diode, and an integrated circuit) were appraised in detail in order to evaluate the practicality of such appraisals for use in parts programs for advanced planetary missions. Five samples of each type were assessed for adequacy of design, manufacturing processes, and screening methods. The appraisals were accomplished by dissection, visual inspection, failure analysis, and testing. K.W.

N69-18965*# Sperry Rand Research, Sudbury, Mass
RESEARCH ON VARIABLE THRESHOLD TRANSISTOR STORAGE SYSTEMS, PHASE 1 Final Report
A. J. Lincoln, R. E. Oleksiak, and T. R. Williams Oct. 1968 52 p
(Contract NAS12-686)
(NASA-CR-86120; SRRC-CR-68-45) Avail: CFSTI CSCL 09A

The metal nitride semiconductor variable threshold transistor (MNS-VTT) is a field effect transistor whose gate turn-on threshold can be shifted semipermanently but reversibly by application of a suitable setting potential. As such it offers promise as the storage element in an electrically alterable, nonvolatile integrated semiconductor memory array. A number of tests were performed to allow characterization of the MNS-VTT as a memory circuit element. These tests demonstrated parameters such as permanence of storage, writing speed and voltage requirements, gain, temperature behavior, and interrogation delay. Different memory systems organization techniques and circuits were studied and evaluated to determine the most effective method of constructing integrated memories from the MNS-VTT's. Several experimental systems were constructed. One of these, the "channel shielded memory," was selected as the best prospect for future development. Author

N69-18998*# Westinghouse Electric Corp., Youngwood, Pa. Semiconductor Div.
DESIGN AND DEVELOPMENT OF A HIGH POWER, LOW SATURATION VOLTAGE SILICON SWITCHING TRANSISTOR Final Report
Ernest R. Stonebraker Dec. 1968 129 p Prepared for JPL
(Contract NAS7-100; JPL-952043)
(NASA-CR-100214) Avail: CFSTI CSCL 09A

The design selection and processing of final samples of a transistor capable of meeting the required very low saturation voltage ($V_{CE(sat)} \leq 0.1V$ at 75A collector current with a base current of 5A) are discussed in detail. A review is presented of earlier phases of the development, followed by a discussion of the final design selection. Out of three possible approaches, the thin wafer was chosen, because this structure offered low bulk resistances, symmetry of doping profiles in the emitter and collector regions, and high gains. In order to circumvent problems met in fabricating thin wafer transistors, the structure was approximated using the epitaxial growth technique. A complete process flow for this device is described, and the results of the several approaches are compared as to factors affecting saturation voltage and design, processing, and handling difficulties encountered. It is recommended that an overdesigned or underrated single chip should be considered in order to consistently obtain extremely low saturation voltages; larger single chip devices should evolve as material quality improves and process control continues. A.C.R.

N69-19006# Office of State Technical Services, Washington, D. C.
ELECTRONIC AND ELECTRICAL ENGINEERING: SELECTED BIBLIOGRAPHIC CITATIONS ANNOUNCED IN U.S. GOVERNMENT RESEARCH AND DEVELOPMENT REPORTS, 1968
Mar. 1968 39 p refs
(STS-107; PB-180136) Avail: CFSTI CSCL 9C

Selected reviews and abstracts are presented on federally sponsored research and development in the areas of electronic and electrical engineering. Author

N69-19072# Kernforschungsanlage, Juelich (West Germany). Inst. fur Plasmaphysik.
A 2MA METAL-TO-METAL SWITCH WITH 0.1 μ/SEC JITTER TIME
P. Dokopoulos Jun. 1968 21 p refs Sponsored in part by EURATOM
(Jul-539-PP) Avail: CFSTI

A foil switch of plane configuration with low inductance and low resistance is described. An exploding aluminum foil drives the two switch electrodes together: the insulation is sheared and a metal-to-metal contact results. Clamp and start switching have been possible on circuits having a voltage up to 60 kV, a frequency up to 300 kHz and a current up to 2 MA. The delay is 3.4±0.1 μsec for a 2 MA current rating and a 0.4 mm polythene insulation; decreasing the current rating or the insulation thickness decreases the delay too. High current (MA) pulses of a few μsec risetime and more than 1 msec decay time with less than 2% oscillations have been produced in clamped circuits with small inductive loads (20 nH). An analysis of the current-time dependence after clamping an inductance with such a switch is given. The theoretical results have been found to be in accordance with the experimental data. Author (ESRO)

N69-19075*# Electro-Optical Systems, Inc., Pasadena, Calif.
THERMIONIC RESEARCH AND DEVELOPMENT PROGRAM
D. L. Jacobson and R. W. Hamerdinger 3 Feb. 1969 65 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952217)
(NASA-CR-100209; EOS-4008-Q-3; QPR-3) Avail: CFSTI CSCL 10B

A program of advanced thermionic converter development is presented. An investigation of single-crystal rhenium and tungsten alloy materials is given. The purpose of the investigation is to yield a high bare work function surface. Specific investigations include vacuum emission vehicle determination of the effective work functions and examination of electrode surfaces using a thermionic emission microscope. Metallographic examinations are also included. The investigation of CVD W/22-26 Re electrodes is discussed. Bare work function measurements are made with the vacuum emission vehicle, and the electrode surface is examined with the thermionic emission microscope. The electrode material is then incorporated into a variable parameter vehicle, a planar converter, and a cylindrical converter. The design, fabrication, and testing of CVD rhenium-electrode cylindrical thermionic converters is completed for the principal purpose of providing a performance comparison between planar and cylindrical geometries. Author

N69-19273# Oulu Univ. (Finland). Dept. of Electrical Engineering.
THE MEASURING METHODS OF CYCLOTRON RESONANCE AT MICROWAVE FREQUENCIES
P.-L. Kalliomaeki and K. Kalliomaeki 1968 16 p refs
(S-4) Avail: CFSTI

Methods of cyclotron resonance measurement performed of microwave frequencies are discussed. The sensitivity of the methods and the influence of the cavity matching are considered. In addition a selective sweeping method, developed from the sweeping method, is presented. This measuring circuit can be constructed together with the stabilization circuits for the power and frequency of the generator. Author

N69-19348# LTV Electrosystems, Inc., Greenville, Tex.
APPLYING THE KALMAN FILTER TO PULSE SIGNAL RESTORATION
J. W. Bayless, J. C. Eby, and C. N. Kelly Jan. 1969 17 p
(G3685-05.02E) Avail: Issuing Activity

Kalman filter theory has been applied to the estimation of pulse waveforms which have been distorted by filtering and which have been corrupted by noise. This has been extended to include the inverse filtering problem. Analog computer simulation results for several examples are presented. It is shown that restorations to a close approximation of the original pulse shape can be achieved. Author

N69-19384# European Atomic Energy Community, Geel (Belgium). Joint Nuclear Research Center.
THE FABRICATION OF ENCAPSULATED Ge (Li) DETECTORS OF γ-SPECTROSCOPY
H. Meyer, H. L. Eschbach, W. Nagel, and E. W. Kruidhof 1968 22 p refs
(EUR-4063.E) Avail: CFSTI

The procedure and the equipment for the fabrication of encapsulated Ge (li) detectors are described. The detector crystals are placed in aluminum capsules hermetically sealed by cold pressure welding. The important details of the welding process to ensure reliable welds are discussed. Proper crystal mounting, clean helium atmosphere in the capsules and a carefully constructed feedthrough avoid biasing limitations and allow long term stability of the detector characteristics. Background degradation due to the encapsulation of detectors irradiated with γ-rays was not detected. Author

N69-19389# Sperry Gyroscope Co., Ltd., Brentford (England). Engineering Dept.
A SURVEY OF OVERVOLTAGE PROTECTION TECHNIQUES FOR DIGITAL INTEGRATED CIRCUIT EQUIPMENTS
M. Tiley Nov. 1967 8 p
(TN-929) Avail: CFSTI

In the techniques described, consideration is given to protection at sub unit level, drawing load currents from 100 to 500 mA. Transient overvoltage protection plus power supply cutout is discussed in terms of zener diode protection, series regulator protection, and zener transistor protection. For fuse protection, a series fuse is followed by a voltage clamp circuit. Since the fuse takes a finite time to blow, the voltage clamp circuit must be able to absorb transient overload power. The application of this principle to zener fuse protection, shorting zener fuse protection, and SCR fuse protection is assessed. The advantages of continuous protection are cited. Circuit diagrams are included. M.G.J.

N69-19407*# General Precision, Inc. Glendale, Calif. Librascope Group.
STUDY OF FAILURE AND RELIABILITY OF MICROELECTRONICS DEVICES Quarterly Report, 1 Jul.–30 Sep. 1968
30 Sep. 1968 6 p
(Contract NAS12-72)
(NASA-CR-100254; TR-2-0501; QR-12) Avail: CFSTI CSCL 14D

The following tests were completed in accordance with test procedures for surface defect categories: (1) parameter measurements at temperature extremes (+25, −55, +125 degrees C); (2) high temperature storage; (3) temperature cycling; and (4) acceleration. Without predicting the source or composition of the surface anomalies, or their possible effects, each category, without losing identification, was subjected to the foregoing environmental extremes. The intent is to accelerate any deleterious effects, especially those statistically identifiable with a surface defect

category. Parameter measurement data has not been statistically reduced, but no catastrophic failures have been encountered thus far. Author

N69-19413# Oulu Univ. (Finland). Dept. of Electrical Engineering.
SIMPLE AND PRECISE METHOD FOR MEASURING SEMICONDUCTOR CONDUCTIVITY WITH A MICROWAVE CAVITY
P.-L. Kelliomaeki and K. Kalliomaeki. 1968 5 p
(S-3) Avail: CFSTI

A method for performing semiconductor conductivity measurements at microwaves using the perturbation theory is described. A sweeping measuring system is used with dual beam oscilloscope as an indicator. The first beam measures the reflected power from the wavemeter cavity (resonance dip) and the other beam the reflected power from the measuring cavity (absorption). In order to obtain the reflection coefficient, the ratio of the powers, reflected from the cavity at resonance, is measured by the bolometer, attenuator, and oscilloscope. Variations 1/10 in the conductivity of the same sample can be measured and, if the change of the sign of the reflection coefficient is allowed for during the measurement, variations 1/100 can be observed. The accuracy in the measurement of the reflection coefficient is determined by the bolometer and the directional coupler, and it is nearly 1%. Author

N69-19431*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ENGINEERING MECHANICS DIVISION
In its Space Programs Sum. No. 37-54, Vol. 3, Oct.-Nov. 1968 31 Dec. 1968 p 83-90 refs (See N69-19427 08-34)
Avail: CFSTI CSCL 09A

Results of continuing research in the area of electronic parts engineering are reported. Screening methodology for the metal oxide semiconductor field effect transistor is discussed, since new techniques are necessary for this type of equipment as compared to conventional bipolar transistors, due to significant differences in operating principles and design. The power pulse method of screening resistors is also described, as well as high impact survival tests on spacecraft electronic equipment to be used in lunar and planetary exploration programs. In the area of advanced projects development, conceptual approaches to the design of mechanisms for jettisoning a parachute and its associated deployment mortar from a planetary landing capsule are described. A.C.R.

N69-19465# Hahn-Meitner-Institut fur Kernforschung, Berlin (West Germany).
CHANGE OF ELECTRICAL PROPERTIES OF INTEGRATED CIRCUITS BY NEUTRON, ELECTRON, AND GAMMA-RAY IRRADIATION (Co SUP 60) (RTL-FAMILY: NOR GATE FBH 100) [UNTERSUCHUNG DER ANDERUNG DER ELEKTRISCHEN KENNGROBEN VON INTEGRIERTEN SCHALTKREISEN DER RLT-FAMILIE DURCH NEUTRONAN-, ELEKTRONEN- UND GAMMA-STRAHLUNG AM BELSPIEL DES NOR-GATTERS FBH 100]
P. Paxmann and A. Spencker. Aug. 1968 37 p refs In GERMAN; ENGLISH summary
(HMI-B-74) Avail: CFSTI

A survey of the physical and electronic behavior of a NOR-gate of the RTL family is given, and radiation damage by means of ionization and displacement effects are discussed. Measurements of the following quantities and their change by irradiation are discussed: dc current gain, junction leakage currents; I_B-U_{EB}-characteristics of the transistors; resistors; input and output currents; logical 0; transfer function; and transient response of the device. The reduction of current gain because of displacement effects causes failure of the NOR gate. Ionization effects (^{60}Co) do not degrade gate performance substantially. Author (NSA)

10 ELECTRONICS

Includes circuit theory, and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N69-18745# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
SPACE EXPERIMENTS USING SPARK CHAMBERS [EXPERIENCES SPATIALES AVEC LES CHAMBRES A ETINCELLES]
Bernard Agrinier, Bruno Parlier, and Jacques Vasseur. 20 Mar. 1968 30 p refs In FRENCH Presented at the CNES Symp. on Space Technol., Bretigny, France, 12 Mar.-2 Apr. 1968
Avail: CFSTI

The modes of operation of spark chambers and their characteristics are discussed. Some of the technical problems encountered in using space-borne spark chambers are discussed, particularly the digitization of the data for transmission to ground. Consideration is given to some recent experiments. ESRO

N69-19003*# Westinghouse Electric Corp., Lima, Ohio.
INVERTER-CONVERTER AUTOMATIC PARALLELING AND PROTECTION
C. L. Doughman, B. A. Marino, and N. D. Lenhart. Washington NASA Feb. 1969 164 p refs
(Contract NAS3-2792)
(NASA-CR-1225) Avail: CFSTI CSCL 09E

Electrical control and protection circuits are developed for a multi-channel, paralleled ac system and for a multi-channeled, paralleled dc system. Electrical control for each of the two systems consists of automatic paralleling circuits and electrical contactor control circuits. Protection circuits for the ac system include overvoltage, undervoltage, overfrequency, underfrequency, frequency reference protection, overcurrent, load division and differential current. Protection circuits for the dc system are the same as for the ac system except that no frequency protection circuits are included. Test results verify and demonstrate the developed technology. Author

N69-19020*# Rensselaer Polytechnic Inst., Troy, N. Y.
OPTIMAL CONTROL WITH UNAVAILABLE STATES. VOLUME 3 Final Report, May 4, 1967-Nov. 3, 1968
John F. Cassidy, Jr. Nov. 1968 267 p refs
(Contract NAS8-21131)
(NASA-CR-98346) Avail: CFSTI CSCL 12A

The linear specific optimal control problem (SOC problem) is based on the linear quadratic optimal control problem and has the following features: Linear feedback control laws; unavailable state capability; and low computational effort. The above properties are obtained by specifying the structure of some of the weighting matrices of the cost index. The explicit values of these matrices are not known until the problem is solved; that is, part of the solution to a SOC problem involves the completion of the formulation. This approach is justified from a mathematical point of view by the proof of the local existence and uniqueness of the SOC solutions and from an engineering point of view by the successful application of the SOC technique to three general control problems, the unavailable state control problem, the model reference control

problem, and the trajectory sensitivity control problem. In addition numerical methods are developed which allow these techniques to be applied with relatively low computational effort. Of the three methods, the SOC Sensitivity approach appears to be the most promising. A significant feature of this problem is that the computational effort is relatively independent of the number of parameters considered and is of the same order as an unavailable state problem with no sensitivity considerations. Author

N69-19390# Grumman Aircraft Engineering Corp., Bethpage, N. Y.
FORMULATION OF THE MINIMUM TRAJECTORY SENSITIVITY PROBLEM
E. Kreindler Jan. 1969 13 p refs Submitted for publication
(RM-438J) Avail: Issuing Activity

One of the ways to determine the sensitivity of a control system to changes in a parameter is to measure the change in the system state, as a function of time, due to a small change in the parameter. This is referred to as trajectory sensitivity and is a generalization of the concept used in guidance system analysis. The present study seeks to clarify an argument which states that for a linear plant, a formulation of the minimum trajectory sensitivity problems in terms of a standard linear optimal regulator problem is erroneous, and that this requires a different formulation. It is shown that both formulations are correct, and that an interesting relationship exists between the two formulations. K.W.

N69-19440# Joint Publications Research Service, Washington, D. C.
CYBERNETICS AND CONTROL THEORY, USSR
30 Jan. 1969 15 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 183, no. 2, 1968 p 300–306
(JPRS-47341) Avail: CFSTI

CONTENTS:

1. THEORY OF NECESSARY CONDITIONS OF OPTIMALNESS OF SPECIFIC CONTROLS R. Gabasov p 1–4 refs (See N69-19441 08-10)

2. ADAPTIVE SYSTEMS WITH MULTISTAGE TARGET CONDITIONS V. A. Yakubovich p 5–12 refs (See N69-19442 08-10)

N69-19441# Joint Publications Research Service, Washington, D. C.
THEORY OF NECCESSARY CONDITIONS OF OPTIMALNESS OF SPECIFIC CONTROLS
R. Gabasov *In its* Cybernetics and Control Theory, USSR 30 Jan. 1969 p 1–4 refs (See N69-19440 08-10)
Avail: CFSTI

Theorems are proven for the necessary conditions of optimalness for specific first and second order controls. Applications of the lemmas are then made to solve for the cases of convex and open control regions. The required optimalness conditions which were derived differed from the known conditions both with respect to form and with respect to the method by which they were obtained. The variations of the controls used in the equations essentially assumed that U is an open set. B.P.

N69-19442# Joint Publications Research Service, Washington, D. C.
ADAPTIVE SYSTEMS WITH MULTISTAGE TARGET CONDITIONS
V. A. Yakubovich *In its* Cybernetics and Control Theory, USSR 30 Jan. 1969 p 5–12 refs (See N69-19440 08-10)
Avail: CFSTI

A given set of elements, which vary with time, is defined for robots simulating hawk and bicyclist functions. Theorems are constructed for the brain equations (operational manipulational) of these robots and proved for the fact that the robot in question will be rational in dealing with a specific class of problems. B.P.

N69-19554*# Rochester Univ., N. Y. Dept. of Electrical Engineering.
SYNTHESIS OF DISTRIBUTED SYSTEMS Annual Report, Sep. 1, 1967–Aug. 31, 1968
Gerald H. Cohen and Avinash Karnik Aug. 1968 76 p refs
(Grant NGR-33-019-058)
(NASA-CR-66745) Avail: CFSTI CSCL 09E

A distributed parameter system for guiding waves from one point to another in space is analyzed, with the parameter distributions assumed to be unrestricted except for the upper and lower bounds resulting from the imposition of physical relizability. The problem being similar to the sensitivity problem found in the optimal control of systems, an improved version of the first order gradient technique is used to obtain optimal distributions. This technique is sensitive to the form of the arbitrary distributions assumed at the beginning of the iterations and has serious convergence problems, particularly when involved in singular optimal control situations. The improved version devises an algorithm so that the technique becomes less sensitive to the initial assumed distributions, and the convergence problems generated because of the bounds on the parameter distributions are virtually eliminated. Examples of distributed parameter systems to feedback networks for phase shift oscillators and the application of the improved gradient technique are given, with the distributions being obtained by the use of a hybrid computer. Author

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N69-18602# California Univ., Berkeley. Lawrence Radiation Lab.
SYMPOSIUM ON ELECTRON RING ACCELERATORS
Feb. 1968 531 p refs Held at Univ. of Calif., Berkeley, 5–7 Feb. 1968
(Contract W-7405-eng-48)
(UCRL-18103; CONF-680210) Avail: CFSTI

The conference papers presented pertain to acceleration of ions by collective effects. Areas of interest covered are the mathematical background, injection and compression, extraction and acceleration, and stability analysis. For individual titles see N69-18603 through N69-18658.

N69-18603# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
SOME PRELIMINARY THOUGHTS ON ION DRAG ACCELERATORS
W. Bennett Lewis *In* Calif. Univ., Berkeley Symp. on Electron Ring Accelerators Feb. 1968 p 6–10 (See N69-18602 08-11)
Avail: CFSTI

The ion drag process of acceleration is briefly discussed. Topics include Bennett pinch phenomenon for preventing the spreading of electrons, energy transfer from electron to ions, current limits, introduction of axial magnetic fields, and a brief comparison of ion-drag and electron-ring accelerators. NSA

N69-18604# California Univ., Berkeley. Lawrence Radiation Lab.
THE ELECTRON RING ACCELERATOR: GENERAL CONCEPTS AND PRESENT STATE OF THEORETICAL UNDERSTANDING
A. M. Sessler *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 11–33 (See N69-18602 08-11)
(S/ERA-1) Avail: CFSTI

The general concepts of a large number of phenomena associated with the electron-ring accelerator, from experimental and theoretical analysis, are discussed. Topics include compression phase, extraction process, kinematics of expansion, limit on rate of expansion, synchrotron radiation, ionization processes, stripping of heavy elements, beam loading or cavity radiation, Touschek effect, incoherent space charge limit, self focusing, curvature effects, image field focusing, tearing effect of acceleration, negative mass instability, empirical comparison between ERA and Astron, coherent radiation instability (compressor), coherent radiation instability (accelerating column), two-stream instability (azimuthal ion–electron oscillations), two-stream instability (transverse), transverse instabilities, and transverse ring stability in uniform field. NSA

N69-18605# California Univ., Berkeley. Lawrence Radiation Lab.
RADIO FREQUENCY ACCELERATION OF ELECTRON RINGS
F. Voelker *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 34–43 (See N69-18602 08-11)
(S/ERA-5) Avail: CFSTI

The economics and technical aspects of rf acceleration of electron rings are discussed. NSA

N69-18606# California Univ., Berkeley. Lawrence Radiation Lab.
PULSED LINE ACCELERATION OF ELECTRON RINGS
E. C. Hartwig *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 44–64 (See N69-18602 08-11)
(S/ERA-4) Avail: CFSTI

The pulsed line method of accelerating electron rings by a travelling wave with an axial electric field produced by properly synchronized pulses applied to cavities is described. NSA

N69-18607# California Univ., Berkeley. Lawrence Radiation Lab.
ELECTRON RING ACCELERATOR: ENGINEERING CONSIDERATIONS
W. W. Salsig *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 65–76 (See N69-18602 08-11)
(S/ERA-3) Avail: CFSTI

Two types of apparatus are discussed. First, the experimental test apparatus for forming and compressing an electron ring is considered. Next, an example model of an rf accelerating column of significant energy is examined. Preliminary cost estimates are included. NSA

N69-18608# California Univ., Berkeley. Lawrence Radiation Lab.
EXPERIMENTAL USE
Denis Keefe *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 79–88 (See N69-18602 08-11)
Avail: CFSTI

The characteristics of a 70-GeV proton electron-ring accelerator are discussed. These include time structure, beam emittance, and energy spread. The use of a stretching ring, in which the beam can be debunched and spread out roughly uniform in time, for physics experiments is examined. Physics experiments without the use of the stretching ring are also examined. (NSA)

N69-18609# California Univ., Berkeley. Lawrence Radiation Lab.
THE LRL MODEL PROGRAM
J. M. Peterson *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 89–100 (See N69-18602 08-11)
Avail: CFSTI

A model of an electron-ring accelerator used to understand the new concepts and mechanism involved, is described. It is the function of the model to form a ring of about 10^{13} electrons and to compress it to the point where it can hold an interesting number of protons, or possibly heavy ions. If this is successful both expansion acceleration and electric acceleration of the electron ring would be attempted. (NSA)

N69-18610# California Univ., Berkeley. Lawrence Radiation Lab.
THE ELECTRON-RING ACCELERATOR
D. Keefe *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 145–163 (See N69-18602 08-11)
Avail: CFSTI

The characteristics of a high-energy accelerator based on coherent field effects are described. A summary of the research at Dubna and LRL is presented with specifics on the model program at LRL. A description of an electron-ring accelerator with specifications for the injector, compressor, ring regulator, accelerator column, conventional facilities, and experimental use is included. (NSA)

N69-18611# California Univ., Berkeley. Lawrence Radiation Lab.
SELECTED TECHNICAL SECTIONS FROM "ACCELERATION BY THE COHERENT FIELD OF AN ELECTRON RING: PROPOSAL FOR AN ACCELERATOR DEVELOPMENT STUDY"
A. M. Sessler *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 164–183 refs (See N69-18602 08-11)
(WC/ERA-25) Avail: CFSTI

Some technical sections from the draft document, with some modifications and corrections, are presented. These include a general description of the accelerator, proposed research program, parameters, injection process, compression process, expansion and acceleration process, rf accelerating structure, incoherent space charge limit, longitudinal instabilities, transverse instabilities, ionization processes, and synchrotron radiation. NSA

N69-18612# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton.
SOME USEFUL PARAMETERS
J. D. Lawson *In* Calif. Univ., Berkeley Symp. on Electron Ring Accelerators Feb. 1968 p 184–185 (See N69-18602 08-11)
(WC/ERA-14) Avail: CFSTI

Some useful parameters based on that given in ERAN-1 with some additions and minor corrections are presented. The parameters are given for electron-ring accelerators during beam injection and the compressed phase. NSA

N69-18613# California Univ., Berkeley. Lawrence Radiation Lab.
A RATHER DIFFERENT SET OF PARAMETERS
A. M. Sessler *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 188–190 (See N69-18602 08-11)
(WC/ERA-15) Avail: CFSTI

A change in parameters is considered which relieves the many-body phenomena and yet preserves the interesting properties of electron-ring accelerators. NSA

N69-18614# California Univ., Berkeley. Lawrence Radiation Lab.
PARAMETERS, PARAMETERS, PARAMETERS
A. M. Sessler *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 191–194 (See N69-18602 08-11)
(WC/ERA-17) Avail: CFSTI

Various parameters for electron-ring accelerators are presented. NSA

N69-18615# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
PRELIMINARY COMPARISON OF ION DRAG ACCELERATOR PROPOSALS (DM-92). APPENDIX A: ION DRAG ACCELERATION BY FALL-OFF OF MAGNETIC FIELD WITH REFERENCE TO THE ELECTRON RING OF THE ACFER PROPOSAL
W. B. Lewis *In* Calif. Univ., Berkeley Symp. on Electron Ring Accelerators Feb. 1968 p 195–206 (See N69-18602 08-11)
(ERAC-25) Avail: CFSTI

Various aspects of ion-drag acceleration by fall-off of the magnetic field are discussed. Topics include basic terminology and conservation relations, relation of γ ($\gamma = 1/\sqrt{1-\beta^2}$ and " denotes parallel to beam axis) and B, acceleration of ions, and Bennett Pinch. NSA

N69-18616# National Accelerator Lab., Batavia, Ill.
CONCERNING A CIRCULAR ELECTRON RING ACCELERATOR
A. A. Garren *In* Calif. Univ., Berkeley Symp. on Electron Ring Accelerators Feb. 1968 p 207–209 (See N69-18602 08-11)
(WC/ERA-21) Avail: CFSTI

The technical aspects of accelerating electron rings containing protons in a circular machine are discussed. Topics include the use of the electric field for providing the centripetal force needed to bend ions around a circular path, size of the accelerator, superconducting solenoidal windings about the vacuum chamber, beam energy and intensity, and beam injection. NSA

N69-18617# Princeton Univ., N. J.
STATIC-FIELD ACCELERATION OF ELECTRON RINGS
H. P. Furth and M. N. Rosenbluth (Inst. for Advanced Study) *In* Calif. Univ., Berkeley Symp. on Electron Ring Accelerators Feb. 1968 p 210–218 ref (See N69-18602 08-11)
(WC/ERA-30) Avail: CFSTI

The properties of a simple axisymmetric static-field accelerator are considered and some limitations that are encountered once magnetic-moment conservation has been removed as the limiting factor are pointed out. NSA

N69-18618# California Univ., Berkeley. Lawrence Radiation Lab.
ACCELERATION OF POSITIVE IONS WITH A SWEPT BEAM OF ELECTRONS
R. M. Johnson *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 219–223 ref (See N69-18602 08-11)
(WC/ERA-33) Avail: CFSTI

A method for accelerating protons or positive ions using only a swept beam of electrons in a manner similar to that used in a cathode-ray tube is described. NSA

N69-18619# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton.
NOTES ON RELATIVISTIC KINEMATICS
J. D. Lawson *In* Calif. Univ., Berkeley Symp. on Electron Ring Accelerators Feb. 1968 p 224–227 (See N69-18602 08-11)
(WC/ERA-13) Avail: CFSTI

Notes on relativistic kinematics pertinent to design of electron-ring accelerators are presented. NSA

N69-18620# California Univ., Berkeley. Lawrence Radiation Lab.
COMPUTATIONAL PROGRAM
L. Jackson Laslett *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 228–236 (See N69-18602 08-11)
(WC/ERA-1) Avail: CFSTI

Two types of computer programs set up for application to the electron-ring development program at LRL are described. One type of program is concerned with the question of particle handling, either concerning the fields and dynamics of compression, or with the fields one might maintain down the acceleration tube. The second type of program concerns the fields of the beam itself. Initial results from the use of these programs are outlined. NSA

N69-18621# California Univ., Berkeley. Lawrence Radiation Lab.
COMPUTER PROGRAMS
L. Jackson Laslett *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 237–244 (See N69-18602 08-11)
(ERAN-16) Avail: CFSTI

Computer programs are described for use on the LRL CDC-6600 for the solution of certain computational problems relating to the Collective Ion Accelerator. The areas treated were space charge fields including self-fields of ring and image-field coefficients for ring in a conducting tube, compression fields and dynamics, and fields from a periodic azimuthal current on the surface of a tube. NSA

N69-18622# California Univ., Berkeley. Lawrence Radiation Lab.
CONCERNING THE FORCE ON A CURRENT RING IN AN ELECTROMAGNETIC FIELD
L. Jackson Laslett *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 245–253 refs (See N69-19602 08-11)
(ERAN-5) Avail: CFSTI

The dynamical equations of a charged particle can be written and analyzed in any inertial frame on one's choosing. It is shown, however, by means of an example, that one must exercise restraint in attempting to transform the force on the ring as-a-whole from one such inertial frame to another. NSA

N69-18623# California Univ., Livermore. Lawrence Radiation Lab.
NOTE ON THE COMPRESSOR COIL SYSTEM FOR ERA
J. W. Beal *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 254–262 (See N69-18602 08-11)
(ERAN-9) Avail: CFSTI

Some computer calculations pertaining to the compressor coil system design for a collective ion accelerator are presented. It was desired to take a preliminary look at the coil system with respect to several accelerator parameters. The computer calculation is for dc vacuum fields with no provisions for eddy currents, etc. in nearby conducting elements. NSA

N69-18624# California Univ., Berkeley. Lawrence Radiation Lab.
CONCERNING THE DAMPING OF ORBIT RADIUS IN A PULSED FIELD
L. Jackson Laslett *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 263–269 (See N69-18602 08-11)
(WC/ERA-5) Avail: CFSTI

A study of the compression process, in an axially symmetric field of a pulsed coil or coil system, is presented. The principles involved in the compression process are illustrated. NSA

N69-18625# California Univ., Berkeley. Lawrence Radiation Lab.
CONCERNING THE DAMPING OF MINOR RADIUS FOR A TOROID (DURING COMPRESSION)
L. Jackson Laslett *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 270–272 (See N69-18602 08-11)
(WC/ERA-6) Avail: CFSTI

The consequences of energy spread in the particles that are injected simultaneously onto their respective circular orbits, as distinct from the damping of betatron oscillations for particles that have a common energy, are examined. NSA

N69-18626# California Univ., Berkeley. Lawrence Radiation Lab.
CONCERNING THE AMPLITUDES OF OSCILLATION FOR POSITIVE IONS IN THE ELECTROSTATIC FIELD OF AN ELECTRON BEAM WHOSE MINOR RADIUS b IS DAMPED (TOTAL ELECTRON CHARGE IS CONSTANT)
L. Jackson Laslett *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 273–274 (See N69-18602 08-11)
(ERAN-14) Avail: CFSTI

An equation for describing the amplitudes of oscillation for positive ions in the electrostatic field of an electron beam whose minor radius is damped when the total electron charge is constant is derived. NSA

N69-18627# California Univ., Berkeley. Lawrence Radiation Lab.
POTENTIAL WELL OF A TOROID
L. Jackson Laslett *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 275–278 (See N69-18602 08-11)
(ERAN-7) Avail: CFSTI

Computational results are reported for the electrostatic potential of a toroid of major radius R, minor radius b, and constant charge density $Q/2\pi^2Rb^2$ per unit volume (esu). The potential as evaluated is positive; if Q were negative, the potential would provide a potential well for positive ions. NSA

N69-18628# California Univ., Berkeley. Lawrence Radiation Lab.
SELF-FIELDS OF A TOROID
L. Jackson Laselt *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 279–290 (See N69-18602 08-11)
(ERAN-8) Avail: CFSTI

The self fields of a toroidal charge and current distribution were examined with the object of determining to what extent space-charge forces (that act on a single particle) differ from the forces calculable for a straight beam. NSA

N69-18629# California Univ., Berkeley. Lawrence Radiation Lab.
CONCERNING THE ELECTROSTATIC FIELD OF IONS LOADED INTO A UNIFORM ELECTRON BEAM
L. Jackson Laslett *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 291–297 (See N69-18602 08-11)
(WC/ERA-19) Avail: CFSTI

The density distribution of ions and their associated electric field are investigated when a relatively small number of ions is introduced in a uniform electron beam, such as that used to form the toroidal current of the projected Electron Ring Accelerator. NSA

N69-18630# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton.
THE EFFECT OF TRAPPED IONS ON THE Q-VALUES AT INJECTION
J. D. Lawson *In* Calif. Univ., Berkeley Symp. on Electron Ring Accelerators Feb. 1968 p 298–300 (See N69-18602 08-11)
(WC/ERA-4) Avail: CFSTI

The effect of trapped ions on the Q-values at injection is discussed. The contribution to the actual Q arising from the self field is included. (NSA)

N69-18631# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton.
BUILD UP OF ELECTRON OSCILLATION AMPLITUDE IN RING IF THE Q SUB R EQUALS 1 RESONANCE IS CROSSED
J. D. Lawson *In* Calif. Univ., Berkeley Symp. on Electron Ring Accelerators Feb. 1968 p 301–303 (See N69-18602 08-11)
(WC/ERA-20) Avail: CFSTI

The presence of ions in the electron ring increases Q_V and Q_R where $Q_V = n^{1/2}$ and $Q_R = (1-n)^{1/2}$ and n is the field index; since $n = 0$ for transfer of the ring to the accelerating region (unless it is held in a travelling-wave field) it follows that $Q_R > 1$, so that an integral resonance needs to be passed, or Q_R made >1 at injection with the aid of strong focusing. The former possibility is considered and the rate at which the resonance must be crossed if disastrous blow-up is to be avoided. If the ring is held stationary during ionization period, dQ/it is determined by the ionization rate; alternatively if the fields are changed dQ/dt is determined by the detailed way in which the change occurs. NSA

N69-18632# Wisconsin Univ., Madison.
ON THE TOLERANCES NECESSARY TO CROSS THE Q_R=1 RESONANCE
K. R. Symon *In* Calif. Univ., Berkeley Symp. on Electron Ring Accelerators Feb. 1968 p 304–317 (See N69-18602 08-11)
(WC/ERA-28) Avail: CFSTI

The radial equation of motion for an electron in a ring such as that used in electron-ring accelerators is solved near the integral resonance Q=1. The tolerance in coil displacement is determined. It is considered whether nonlinearities may help to reduce the growth in amplitude when the resonance is crossed. NSA

N69-18633# Avco-Everett Research Lab., Everett, Mass.
STRIPPING OF HEAVY ELEMENTS IN THE ERA
R. H. Levy *In* Calif. Univ., Berkeley Symp. on Electron Ring Accelerators Feb. 1968 p 318–321 (See N69-18602 08-11)
(WC/ERA-2) Avail: CFSTI

The stripping time and rate of production of heavy ions in the Electron-Ring Accelerator are calculated. NSA

N69-18634# Stanford Linear Accelerator Center, Calif.
ION LOSS BY ELECTRON SCATTERING IN COMPRESSED ELECTRON RINGS
R. H. Helm *In* Calif. Univ., Berkeley Symp. on Electron Ring Accelerators Feb. 1968 p 322–327 (See N69-18602 08-11)
(WC/ERA-35) Avail: CFSTI

The heating by electron scattering on the ions trapped in a compressed electron ring can in principle lead to ion energies sufficient to permit escape from the potential well. A correct treatment of this question presumably would include the effects of random and systematic fluctuations in electron density, in which many particles might act collectively in exciting the ions. The purpose of the present note is to investigate the much simpler problem in which the ring is assumed to be uniform and quiescent, and the scattering events are assumed to be random and uncorrelated. Three separate processes are considered: single scattering, escape momentum to the ion; azimuthal drag, in which the recoils from many small-angle events result in a cumulative tangential acceleration

of the ions, and random walk, or statistical accumulation of impulses normal to the electron velocity. NSA

N69-18635# European Organization for Nuclear Research, Geneva (Switzerland).
EXTRACTION OF ELECTRON RINGS BY A SEQUENCE OF AXIALLY SHIFTED COIL PAIRS
E. Keil *In* Calif. Univ., Berkeley Symp. on Electron Ring Accelerators Feb. 1968 p 328–331 (See N69-18602 08-11)
(WC/ERA-10) Avail: CFSTI

After compression in the compression chamber the electron rings want to be displaced in the axial direction to a point where they can be picked up by the rf accelerating field. A system of coils is described which achieves this aim in such a way that the axial and radial stability of the electron rings is concerned without relying on self focusing. Author (NSA)

N69-18636# California Univ., Berkeley. Lawrence Radiation Lab.
PULSED ACCELERATING COLUMN AND PULSED MAGNETIC FIELD FOR THE ELECTRON RING ACCELERATOR
A. Faltens, E. C. Hartwig, and P. Hernandez *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 332 – 340 (See N69-18602 08-11)
(ERAN-12) Avail: CFSTI

The electric field pulse for accelerating the electron ring and magnetic field pulse for focusing the electron-ring in an Electron Ring Accelerator are discussed. Two structures which have the most desirable properties for pulsed acceleration are described. NSA

N69-18637 Gt. Brit. National Inst. for Research in Nuclear Science, Chilton.
ON LINEAR ACCELERATION
W. Walkinshaw *In* Calif. Univ., Berkeley Symp. on Electron Ring Accelerators Feb. 1968 p 341–343 (See N69-18602 08-11)
(WC/ERA-37) Avail: CFSTI

The kinematics of particle motion in a linear accelerator, as might be usefully noted with respect to the acceleration of a charged macro particle such as the electron ring of the Electron-Ring Accelerator, are discussed. Most particularly, the relevance might be with respect to the lock-in behavior that is obtained when $\beta = v/c$ comes quite close to unity and with respect to the tolerances that must be met during the lower-energy stages of acceleration. NSA

N69-18638# National Accelerator Lab., Batavia, Ill.
REMARKS ON THE COMPRESSOR: ACCELERATOR INTERFACE
L. Smith *In* Calif. Univ., Berkeley Symp. on Electron Ring Accelerators Feb. 1968 344–349 (See N69-18602 08-11)
(WC/ERA-31) Avail: CFSTI

The synchronization problem for compression, release, and timing in electron-ring accelerators is discussed. The problem is considered for pulsed-line and rf linac accelerators. NSA

N69-18639# Stanford Linear Accelerator Center, Calif.
CONCERNING THE AXIAL ACCELERATION OF ELECTRON RINGS
P. L. Morton *In* Calif. Univ., Berkeley Symp. on Electron Ring Accelerators Feb. 1968 p 350 – 362 ref (See N69-18602 08-11)

The question as to whether the longitudinal phase motion of the ring is stable if the total charge and mass of the ring differ from the values for which the accelerating structure was designed is discussed. The question of the tearing apart of electrons as well as the separation of the protons from the electrons due to rf fields is treated. (NSA)

N69-18640# California Univ., Berkeley. Lawrence Radiation Lab.
RADIATION BY A RELATIVISTIC PARTICLE PASSING THROUGH A CAVITY
A. Faltens *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 363–364 (See N69-18602 08-11)
(WC/ERA-26) Avail: CFSTI

The radiation emitted from the energy loss of a relativistic charged particle passing through a cavity is discussed. An equation describing the energy loss is presented. NSA

N69-18641# Stanford Linear Accelerator Center, Calif.
THE INTERACTION OF A RING OF CHARGE PASSING THROUGH A CYLINDRICAL RF CAVITY
P. L. Morton and V. K. Neil (Calif. Univ., Livermore. Lawrence Radiation Lab.) (See N69-18602 08-11)
(WC/ERA-29) Avail: CFSTI

The maximum energy that an electron ring can gain in the axial direction by means of rf cavities resonating in the lowest mode is discussed. The energy gained by the electron ring is written as $\Delta U = AQ - BQ^2$, where A and B are constants that depend on both the cavity geometry and the phase and magnitude of the accelerating field, and Q is the total charge in the ring. A constants A and B are determined. NSA

N69-18642# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton.
WHAT IS THE AXIAL EXTENT OF THE RING, AND THE FIELD AVAILABLE TO ACCELERATE THE IONS?
J. D. Lawson *In* Calif. Univ., Berkeley Symp. on Electron Ring Accelerators Feb. 1968 p 376–378 (See N69-18602 08-11)
(WC/ERA-12) Avail: CFSTI

Previously parameters for the Electron Ring Accelerator have been given assuming that the ring contracts down to a minor radius of 0.09 cm, and that the equilibrium position of the ions during acceleration is at the edge of the minor axis. Unless special measures are to be taken, both these assumptions are said to be very optimistic. Both these factors are examined. NSA

N69-18643# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton.
CRITERION FOR ELECTRONS TO PULL AWAY FROM IONS WHEN CROSSING THE RF GAP
J. D. Lawson *In* Calif. Univ., Berkeley Symp. on Electron Ring Accelerators Feb. 1968 p 379–382 (See N69-18602 08-11)
(WC/ERA-16) Avail: CFSTI

The criterion for an ion bunch to move from $r = 1/2a$ to $r = a$ where a is radius of the electron ring as the ring crosses a rf gap is presented. NSA

N69-18644# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali.
REMARKS ON THE ELECTRON-ION RING AXIAL MOTION
C. Pellegrini *In* Calif. Univ., Berkeley Symp. on Electron Ring Accelerators Feb. 1968 p 383–388 (See N69-18602 08-11)
(WC/ERA-18) Avail: CFSTI

The motion of the ring in the z (axial) direction defined by the axis of the magnetic field which extends all along the accelerating column is considered. The ring is a two component system, electrons and ions, on which are acting external forces due to either electric fields or to a gradient in the axial magnetic field.

In addition there are the internal forces which are treated only in linear approximation. NSA

N69-18645# National Accelerator Lab., Batavia, Ill.
ORBIT EQUATION WITH TORSION
Lee C. Teng *In* Calif. Univ., Berkeley Symp. on Electron Ring Accelerators Feb. 1968 p 389–400 (See N69-18602 08-11)
(WC/ERA-27) Avail: CFSTI

Differential equations are developed for particle motion about a curve with torsion. NSA

N69-18646# California Univ., Berkeley. Lawrence Radiation Lab.
INCOHERENT RING IMAGES IN A CIRCULAR CYLINDER: ANALYSIS AND PROPOSED COMPUTATIONAL PROGRAM
L. Jackson Laslett *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 401–418 (See N69-18602 08-11)
(ERAC-38) Avail: CFSTI

Equations were derived for analysis of an incoherent ring image in a circular cylinder. The computer program RIMIC (Ring Image, Incoherent) investigating the image fields, with ac boundary conditions applied to magnetic field at the tube walls was proposed. NSA

N69-18647# California Univ., Berkeley. Lawrence Radiation Lab.
INCOHERENT RING IMAGE IN A CIRCULAR CYLINDER: RESULTS
L. Jackson Laslett *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 419–425 (See N69-18602 08-11)
(WC/ERA-7) Avail: CFSTI

The results of an investigation of the relevant image fields, with ac boundary conditions applied to the magnetic field at the tube walls, using the RIMIC program are presented. NSA

N69-18648# California Univ., Berkeley. Lawrence Radiation Lab.
ENHANCEMENT OF INCOHERENT RING-IMAGE FOCUSING THROUGH USE OF DIELECTRIC
L. Jackson Laslett *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 426–430 (See N69-18602 08-11)
(WC/ERA-9) Avail: CFSTI

The use of a thin dielectric layer at the surface of the accelerating tube in an electron-ring accelerator to achieve single-particle axial stability for an unneutralized beam is discussed. NSA

N69-18649# California Univ., Berkeley. Lawrence Radiation Lab.
TOUSCHEK PHENOMENON IN THE ERA
A. M. Sessler *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 431 (See N69-18602 08-11)
(WC/ERA-24) Avail: CFSTI

The transfer rate from transverse to longitudinal energy is evaluated. NSA

N69-18650# California Univ., Livermore. Lawrence Radiation Lab.
EMPIRICAL COMPARISONS OF THE ERA WITH OBSERVATIONS OF RF IN THE ASTRON
R. J. Briggs *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 432–433 (See N69-18602 08-11)
(WC/ERA-8) Avail: CFSTI

In the normal mode of beam injection in the Astron, an instability is observed during the first few microseconds for injected currents greater than the order of 18–20 A. The question of how one might guess about the stability of the Electron-Ring Accelerator on the basis of the Astron observations is examined. NSA

N69-18651# California Univ., Livermore. Lawrence Radiation Lab.
COHERENT "RADIATIVE" INSTABILITIES OF THE COMPRESSED ELECTRON RING
R. J. Briggs *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 434–441 (See N69-18602 08-11)
(WC/ERA-11) Avail: CFSTI

The azimuthal stability of an electron ring situated in a circular pipe of infinite length is considered. It is concluded that if the pipe radius is large enough for a mode synchronous with the beam to propagate, that the coupling of the beam with this mode can lead to a potentially dangerous instability. The first section has the conditions to propagate, the second has the field analysis (g-factor calculation), and the third section discusses growth rates and stability conditions for various cases and the order of magnitude of the reduction rate from a developed instability. Author (NSA)

N69-18652# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
EFFECT OF COHERENT RADIATION DURING RING COMPRESSION
Claudio Pellegrini and A. M. Sessler (Calif. Univ., Berkeley Radiation Lab.) *In* Calif. Univ., Berkeley Symp. on Electron Ring Accelerators Feb. 1968 p 442–445 (See N69-18602 08-11)
(WC/ERA-22) Avail: CFSTI

Several parameters are evaluated and mathematical descriptions are presented for describing the effect of coherent radiation during ring compression in electron-ring accelerators. NSA

N69-18653# California Univ., Livermore. Lawrence Radiation Lab.
RESOLUTION OF AN APPARENT DISCREPANCY BETWEEN THE RESULTS OF IVANOV AND BRIGGS-NEIL
V. K. Neil *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 446–447 (See N69-18602 08-11)
(WC/ERA-23) Avail: CFSTI

The work of Ivanov on influence of shielding on the negative mass effect and the results of Briggs and Neil on negative mass instability in a cylindrical layer of relativistic electrons are examined. NSA

N69-18654# Wisconsin Univ., Madison.
MUTUAL OSCILLATIONS OF IONS AND ELECTRONS IN THE ERA
F. E. Mills *In* Calif. Univ., Berkeley Symp. on Electron Ring Accelerators Feb. 1968 p 448–456 (See N69-18602 08-11)
(WC/ERA-36) Avail: CFSTI

The forces exerted on the electrons and ions in an electron-ring accelerator from the image field, with emphasis on the restoring force which is centered on the local θ position of the beam, are discussed. NSA

N69-18655# California Univ., Livermore. Lawrence Radiation Lab.
NOTES ON THE INTERACTION OF ELECTRON RING WITH IONS
T. K. Fowler *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 457–466 refs (See N69-18602 08-11)
(UC/ERA-3) Avail: CFSTI

Brief notes are presented describing the interaction of electron-rings with ions in electron-ring accelerators. NSA

N69-18656# California Univ., Berkeley. Lawrence Radiation Lab.
INFLUENCE OF SHIELDING ON THE NEGATIVE-MASS EFFECT [VLIYANIYE EKRANIROVKI NA EFFEKT OTRITSATELNOY MASSY]
I. N. Ivanov *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 467–483 refs Transl. into ENGLISH from JINR Preprint P9-3476-2 (See N69-18602 08-11)
(UCRL-TRANS-1370) Avail: CFSTI

The effect of the conducting surface on the development of instability of the negative mass type was investigated for the case of infinite completely charged cylinders with azimuthal current, surrounded by metallic jacket. It was shown that the screening decreases the increments of growth of the instability. Author (NSA)

N69-18657# California Univ., Berkeley. Lawrence Radiation Lab.
STABILITY OF A RING CURRENT IN A CYLINDRICAL CAVITY [USTOYCHIVOST'KOL'TSEVOGO TOKA V TSILINDRICHESKOM REZONATORE]
I. N. Ivanov *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 484–500 refs Transl. into ENGLISH from JINR Preprint P9-3474-2 (See N69-18602 08-11)
(UCRL-TRANS-1368) Avail: CFSTI

If charged beams are inserted in the resonator, then instabilities can arise in it, connected with the interaction of the beam with the natural field of the resonator. An instability of such a type was investigated for ring configurations in the cylindrical resonator. The increments of the growth of the instability in infinitely fine current ring was found. The results were easily generalized to the formation of the type of E layers. All examinations were made in the framework of hydrodynamics with zero thermal moments. Author (NSA)

N69-18658# California Univ., Berkeley. Lawrence Radiation Lab.
THE STABILITY OF A CYLINDRICAL LAYER OF ELECTRONS, SURROUNDED BY A METAL SHIELD IN A UNIFORM MAGNETIC FIELD [USTOYCHIVOST OKRUZHENNGO METALLICHESKIM EKRANOM TSILINDRICHESKOGO SLOYA ELEKTRONOV V ODNORODNOM MAGNITOM POLE]
I. N. Ivanov and V. G. Makhankov *In its* Symp. on Electron Ring Accelerators Feb. 1968 p 501–522 refs Transl. into ENGLISH from JINR preprint P9-3475-2 (See N69-18602 08-11)
(UCRL-TRANS-1369) Avail: CFSTI

The stability of a thin cylindrical electron layer in a magnetic field, in a smooth wave guide (the conductivity of the walls of which are assumed infinite) was investigated. It is shown that not only longitudinal instabilities of the "negative" mass type are indicated, but transverse channels of instability as well. In contrast to flat geometries, where the increments of channeled instabilities in the presence of screens were increased, in cylindrical layers of screens instabilities of such a type are liquidated. Author (NSA)

N69-18763*# Union Carbide Corp., Tonawanda, N. Y. Linde Div.
DEVELOPMENT OF A TURBOCOMPRESSOR GAS BEARING SIMULATOR Final Report
S. V. Lukas Oct. 1968 88 p refs
(Contract NAS3-10927)
(NASA-CR-72479) Avail: CFSTI CSCL 14B

The design, construction, and testing of a gas bearing simulator for a Brayton cycle radial flow turbocompressor is discussed. The gas bearing system consists of two cylindrical journal bearings supported on damped, flexible supports and a double-acting spiral-grooved thrust bearing. The stability of the journal bearings in the horizontal and vertical positions was investigated experimentally. Author

N69-18777# Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucléaires.
STUDY OF THE MODIFICATION OF THE REGULATION OF THE CADARACHE VAN DE GRAAFF GENERATOR [ETUDE DE LA MODIFICATION DE LA REGULATION DU VAN DE GRAAFF DE CADARACHE]
Michel le Bot and Jacky Rion Sep. 1968 24 p refs In FRENCH; ENGLISH summary
(CEA-R-3580) Avail: CFSTI

The complete renewal of the energy control equipment of the Van de Graaff generator at Cadarache has been accompanied by a certain number of modifications intended to improve the running and operation of the assembly. The most important work has been the addition of an extra control loop making it possible to keep the voltage on the accelerating tube in the absence of a beam. Analog simulation has made it possible to show the advantages of this solution and the effect of some of its limits. Author (ESRO)

N69-18791# Rome Univ. (Italy). Scuola di Ingegneria Aerospaziale.
THE PLASMA GENERATOR AT CENTRO RICERCHE AEROSPAZIALI
Carlo Buongiorno and Vittorio Fiorini Jul. 1968 29 p refs In ITALIAN; ENGLISH summary *Its* ATTI del Centro Ric. Aerospaziali No. 17
Avail: CFSTI

A brief description of a 40 kW d.c. arc-jet installation designed at the Centro Ricerche Aerospaziali is given. The arc jet, of coaxial geometry with watercooled electrodes, is installed in a vacuum chamber and discharges in a low pressure (below 3 mm Hg) environment. In the second part, data are given on jet calibration that have first been obtained with calorimeter techniques at ambient pressure, and the efficiency of the plasma jet is also determined. Author (ESRO)

N69-18851 European Organization for Nuclear Research, Geneva (Switzerland). European Committee for Future Accelerators.
UTILIZATION STUDIES FOR A 300 GeV PROTON SYNCHROTRON, VOLUME 1
30 May 1967 424 p refs
(CERN/ECFA-67/16-Vol-1) Avail: CFSTI

This CERN design report for the 300 GeV accelerator contains experimental utilization studies with emphasis on experiment designs, technical possibilities, and an example layout of experimental areas with cost and manpower estimates included. For individual titles, see N69-18852 through N69-18872.

N69-18862 European Organization for Nuclear Research, Geneva (Switzerland)
UTILIZATION STUDIES FOR THE PROPOSED EUROPEAN 300 GeV PROTON SYNCHROTRON
In its Util. Studies for a 300 GeV Proton Synchrotron, Vol. 1 30 May 1967 p 1–67 refs (See N69-18851 08-11)
(CERN/ECFA-67/13/Rev-2-APP-4) Avail: CFSTI

The utilization studies have covered the subjects of secondary-particle yields, experiments and detectors, production and transport of secondary beams, shielding, and experimental-area arrangement. A possible integrated programme representing a reasonable degree of exploitation has been evolved and its

implications on costs and manpower have been examined. Several large track-chamber devices, one of them a liquid-hydrogen system, would seem to be essential instruments at the new accelerator. Several applications of superconductivity, notably in RF separator cavities and large-volume high magnetic-field-systems, await the necessary developments in technology, but it is reasonable to assume that these will occur. Massive shielding will be needed at target stations where the secondary beams originate, but solutions have been found which avoid unreasonable sacrifice in flexibility. Author

N69-18854 European Organization for Nuclear Research, Geneva (Switzerland).
REPORT BY WORKING PARTY ON AREA 1: ECFA WINTER STUDY FOR JANUARY 1967
E. Lillethun, G. Manning, and J. J. Thresher *In its* Util. Studies for a 300 GeV Proton Synchrotron, Vol. 1 30 May 1967 p 131–141 refs (See N69-18851 08-11)
(CERN/ECFA-67/WG2/US-SG2/EL-GM-JJT) Avail: CFSTI

In this report we present a plausible lay-out for experiments that we consider might be done in Area 1 during the first stage of operation of the 300 GeV accelerator. Our scheme envisages three target stations placed in series along the external proton beam. Each station serves two major beam set-ups and two or more "parasitic" beams which could be used either as test beams or for experiments at lower energies. Target stations 1 and 2 follow very closely the scheme proposed by King and Wilson, while target station 3 is similar in design to the system described by Cocconi. There are four beams and the momentum of each may be varied over a wide range even when all the beams are operating simultaneously. The only major restriction in the scheme is the obvious one that the charges of the particles in beams on opposite sides of the external proton beam should have opposite signs. A list of the beams incorporated in our design is given. Author

N69-18855 European Organization for Nuclear Research, Geneva (Switzerland).
BEAM LAYOUT PROBLEMS IN EXPERIMENTAL AREA 2 OF THE 300 GeV ACCELERATOR
N. H. King and E. J. N. Wilson *In its* Util. Studies for a 300 GeV Proton Synchrotron, Vol. 1 30 May 1967 p 143 – 157 refs (See N69-18851 08-11)
(CERN/ECFA-67/WG2/US-SG1/NMK-EJNW-2 Rept-67/109/5/p/cb) Avail: CFSTI

A possible beam outlay in the Area 2 is considered in the present note. Severe problems of compatibility are encountered in attempting to satisfy the conflicting requirements of the various types of proposed experiments. Area 2 is intended to serve the large detecting devices (bubble chambers, and a large magnetic field spark chamber system) which demand longer beams than are required for Area 1. The experiments proposed for the large detectors fall into two categories: weak interactions, involving neutrino-muon beams, and strong interactions, involving RF separated beams. In addition, it may be important that the separated beams should also be available for exploitation by counter techniques, in view of the relatively low κ^-/π^- and p^-/π^- ratios predicted at high energies. Author

N69-18856 European Organization for Nuclear Research, Geneva (Switzerland).
A 60 GeV EXPERIMENTAL AREA FOR THE 300 GeV MACHINE
M. A. R. Kemp, A. Leisne, J. Perain, B. de Sereville, Ph. Tardy-Joubert et al *In its* Util. Studies for a 300 GeV Proton Synchrotron, Vol. 1 30 May 1967 p 159 – 199 refs (See N69-18851 08-11)
(CERN/ECFA-66/WG2/US-SG5/50-GeV-1) Avail: CFSTI

This report describes a possible experimental area for secondary beams up to 40 GeV/c. The assumption that there would be a strongly shielded target hall has been maintained, thus making it possible to reduce the shielding in the main hall where six secondary beams are set up, two of which are suitable for simultaneous operation at 0° production and three for parasitic operation. This target hall does not exclude the possibility of using the primary proton beam in the main hall. The following aspects of this type of experimental area are described below: beam ejection, beam raising, devices for sharing beam between the various targets, beam transport for multiple use of targets, expected secondary flux, experimental equipment, shielding and buildings to house these set-ups. Author

N69-18860 Manchester Univ. (England).
POSSIBLE EXPERIMENT USING A PHOTON BEAM PRODUCED AT A 300 GeV ACCELERATOR
A. B. Clegg (Lancaster Univ., Engl.), P. G. Murphy, and T. Tuma *In* CERN Util. Studies for a 300 GeV Proton Synchrotron, Vol. 1 30 May 1967 p 245–252 (See N69-18851 08-11)
(CERN/ECFA-66/WG2/US-SG2/ABC-PGM-TT1) Avail: CFSTI

We present in this report some studies towards possible experiments using the photon beam from the decay of neutral pions produced on bombarding a target with 300 GeV protons. We have at this stage considered only experiments using the photon base, with the disadvantage that we do not know the bombarding photon energy. We have therefore ignored, so far, the possibility of producing an electron beam and then using this to produce a tagged photon beam. Author

N69-18866 Gt. Brit. National Inst. for Research in Nuclear Science, Chilton.
BUBBLE CHAMBER DESIGN PARAMETERS AT HIGH ENERGIES
C. M. Fisher *In* CERN Util. Studies for a 300 GeV Proton Synchrotron, Vol. 1 30 May 1967 p 309–318 refs (See N69-18851 08-11)
(CERN/ECFA-66/WG2/US-SG3/CMF-1/Rev) Avail: CFSTI

In these notes the application of a large hydrogen/deuterium bubble chamber to the study of both high energy strong interactions and to neutrino interactions will be discussed on very general considerations. The advantages of the liquid hydrogen/deuterium bubble chamber as a target and detector are such that it is now clear that such a device would be very valuable at the 300 GeV/c machine. The techniques of data extraction and analysis may develop considerably over the next decade and ideas already exist for revolutionising the methods of chamber construction. However, the properties of liquid hydrogen will not change and it is on these properties and on very general considerations concerning the nature of the physics to be studied that the proposal for a very large hydrogen chamber is based. The problems of charged particle measurements and the ensuing kinematical fitting will be outlined in an attempt to scale the dimensions, magnetic field and precision necessary to achieve event identification as a function of momentum. The problems of γ-ray detection and the analysis of neutrino interactions are also discussed in very general terms. Author

N69-18867 Gt. Brit. National Inst. for Research in Nuclear Science, Chilton. Applied Physics Div.
A MAMMOTH HYDROGEN BUBBLE CHAMBER FOR USE WITH THE 300 GeV MACHINE
D. B. Thomas *In* CERN Util. Studies for a 300 GeV Proton Synchrotron, Vol. 1 30 May 1967 p 319–327 (See N69-18851 08-11)
(CERN/ECFA-67/WG2/US-SGIII/DBT-2) Avail: CFSTI

This report considers the construction of a mammoth liquid hydrogen chamber. No specific dimensions are given for the chamber, but the constructional techniques proposed are considered suitable for chambers of 5 meters diameter and upwards. The

larger the chamber the more appropriate the method proposed becomes. Preliminary cost estimates have been obtained for construction of such a chamber of assumed dimensions 25 metres diameter by 7 metres deep. Estimating costs of apparatus involving the use of new techniques is never easy. In spite of this it appears that the total cost of such a project could be much less than that of a similar conventional chamber. A further advantage is th reduction in required building time. Author

N69-18868 European Organization for Nuclear Research, Geneva (Switzerland).
BUBBLE CHAMBERS: HEAVY LIQUID CHAMBERS AT THE 300 GeV MACHINE
P. Musset *In its* Util. Studies for a 300 GeV PROTON SYNCHROTRON, Vol. 1 30 May 1967 p 329-332 (See N69-18851 08-11)
(CERN/ECFA-66/WG2/US-SG3/PM-1) Avail: CFSTI

From what we know today, one can conclude that bubble chambers will be very useful at the 300 GeV machine. Before specific apparatus would be precisely designed we need to study what physics we will be likely to do, or more simply, what kind of experiment we can imagine for bubble chamber. We have concerned ourselves here mainly with the possibility for heavy liquid chambers. The high level of equipment of European and CERN laboratories, the physicists' potential, and the diversity of possible experiments requires the existence of diversified chambers in addition to big chambers. Author

N69-18869 Ecole Polytechnique, Paris (France).
SPECIAL BUBBLE CHAMBERS [CHAMBRES A BULLES SPECIALISEES]
J. Badier *In* CERN Util. Studies for a 300 GeV Proton Synchrotron, Vol. 1 30 May 1967 p 333-343 In FRENCH (See N69-18851 08-11)
(CERN/ECFA-66/WG2/US-SG3/JBD-1) Avail: CFSTI

The principal characteristics of bubble chambers are reviewed: size, tracking precision, magnetic field, repetition rate, electronic assessibility, mobility, price and installation factors, and actual operation time. The intrinsic limitations of these characteristics are then assessed. Correlations are made between the diverse aspects, considering the characteristics two by two, with the hope of optimizing an ideal bubble chamber. Three possible solutions are presented based on large size, high magnetic fields, and high repetition rate of bursts. Transl. by B.P.

N69-18870 European Organization for Nuclear Research, Geneva (Switzerland).
LARGE VOLUME MAGNET SPARK CHAMBER FOR OPERATION UP TO 300 GeV
N. H. Lipman and T. G. Walker *In its* Util. Studies for a 300 GeV Proton Synchrotron, Vol. 1 30 May 1967 p 345-355 (See N69-18851 08-11)
(CERN/ECFA-66/WG2/US-SG111/NHL-TGW) Avail: CFSTI

A study group at the Rutherford Laboratory is at present considering the building of a super-conducting spark chamber magnet, essentially in the form of a pair of Halmholtz coils. A possible design has coils with 2 m I.D. and a gap of 1 m between the two coils, thus giving a field of 3 cubic metres, which can be viewed from the side and top. A field of 20 Kgauss is being considered. In this report we consider the extrapolation of this device to operate with a 300 GeV machine. Author

N69-18907 European Organization for Nuclear Research, Geneva (Switzerland). European Committee for Future Acceleration.
UTILIZATION STUDIES FOR A 300 GeV PROTON SYNCHROTRON, VOLUME 2
30 May 1967 436 p refs Partially in ENGLISH and FRENCH
(CERN/ECFA-67/16-Vol-2) Avail: CFSTI

Beams designs, beam transport components, target stations and shielding, and beam splitting are discussed in relation to the utilization of a 300 GeV proton synchrotron. For individual titles, see N69-18908 through N69-18934.

N69-18908 European Organization for Nuclear Research, Geneva (Switzerland).
NEUTRINO BEAMS AT 300 GeV LABORATORY
In its Util. Studies for a 300 GeV Proton Synchrotron, Vol. 2 30 May 1967 p 1-18 (See N69-18907 08-11)
(CERN/ECFA-66/WG2/US-SG1/DHP-R1) Avail: CFSTI

Two conventional beam systems are discussed: the narrow band system (NBS) and the wide band system (WBS), which is a scale up of the neutrino beam in current use at CERN. The essential features and the technical advantages of the two systems are briefly reviewed. Estimates of the comparative ν fluxes from the NBS and WBS are given for a detector of radius 35 cm. It was summarized that the WBS offered high event rates, a large range of neutrino energy, and has definite shielding problems; the NBS has adequate beam resolution, uses standard beam components, and employs modest amounts of shielding. Equipment and cost estimates for the beam design for neutrino experiments are provided. B.P.

N69-18909 European Organization for Nuclear Research, Geneva (Switzerland).
A POSSIBLE 300 GeV/c SECONDARY BEAM
G. Petrucci *In its* Util. Studies for a 300 GeV Proton Synchrotron, Vol. 2 30 May 1967 p 19-30 refs (See N69-18907 08-11)
(CERN/ECFA-66/WG2/US/2/Tr-1) Avail: CFSTI

With the purpose of estimating performances and the minimum cost of a high energy secondary beam starting from an external target, a possible design was considered. Its basic properties are: maximum momentum of 300 GeV/c; angular acceptance $\simeq 10^{-5}$ sr; maximum momentum bite $\pm$ 3%; and total length of 180 m. The beam layout and its optical diagram are depicted. The beam is a classical two stage beam, with a focusing doublet in each stage; the momentum selection is performed in the first stage, and the recombination of the accepted momenta in the second one. The two stages are practically symmetric apart from the two magnets around the production target. A magnification of the source equal to one can consequently be expected at the final image, both in the horizontal and vertical planes. Author

N69-18911 European Organization for Nuclear Research, Geneva (Switzerland).
RF SEPARATED BEAMS FOR THE 300 GeV/c ACCELERATOR
W. Juengst (Kernforschungszentrum, Karlsruhe, W. Ger.), P. Lazeyras, and H. Lengeler *In its* Util. Studies for a 300 GeV Proton Synchrotron, Vol. 2 30 May 1967 p 39-65 refs (See N69-18907 08-11)
(CERN/ECFA-67/WG2-US-SG1/BL-1)Avail: CFSTI

The design of RF separators and RF separted beams that can be used in conjunction with the future 300 GeV/c accelerators is discussed. Both normal and superconducting beam elements and separators are considered allowing bubble chambers or counters to be used in the experiments. The upper limit of kaon-pion separation for the beams is set to be 30, 50, 100, and 150 GeV/c. Cost estimates were made. Author

N69-18912 European Organization for Nuclear Research, Geneva (Switzerland).
PRELIMINARY DESIGN OF A RF-SEPARATOR FOR 100 GeV/c K-π-SEPARATION, PART 1

P. Bernard and H. Lengeler *In its* Util. Studies for a 300 GeV Proton Synchrotron, Vol. 2 30 May 1967 p 67–81 refs (See N69-18907 08-11)
(CERN/ECFA-66/WG-2/US-SG-2/BL-1) Avail: CFSTI

The instrument design is based on a three cavity RF separator using iris loaded circular waveguides which deflect in one plane. In order to avoid particles hitting the walls of the deflectors, it was required that particles should only fill the square cross-section inscribed in the circular hole of the cavities. The particle intensities at the end of the beam are calculated. The possibility of using the separator simultaneously for bubble chambers and counters is considered. B.P.

N69-18913 European Organization for Nuclear Research, Geneva (Switzerland).
PRELIMINARY DESIGN OF A RF-SEPARATOR FOR 100 GeV/c K-pi-SEPARATION, PART 2
P. Bernard and H. Lengeler *In its* Util. Studies for a 300 GeV Proton Synchrotron, Vol. 2 30 May 1967 p 82–95 (See N69-18907 08-11)
(CERN/ECFA-66/WG-2/US-SG-2/BL-2) Avail: CFSTI

A continuation of the studies on the preliminary design of a RF separator for 100 GeV/c kaon–pion separation is presented. The principle of operation of a Maschke type separator is reviewed. Among several possible operation modes for this separator, one is chosen with a target sitting at the edge of the deflected primary beam and with minimum deflection of one kind of particles in the second RF deflector. Separator parameters and momentum bands are calculated. Tolerances, beam contaminations, and rejection ratios are briefly discussed. A comparison is made of the advantages and disadvantages of the Maschke separator with the three cavity separator. B.P.

N69-18914 Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Experimentelle Kernphysik.
A SUPERCONDUCTING RF PARTICLE SEPARATOR FOR K, π SEPARATION AT 150 GeV/c
W. Bauer and W. Juengst *In* CERN Util. Studies for a 300 GeV Proton Synchrotron, Vol. 2 30 May 1967 p 96–115 refs (See N69-18907 08-11)
(CERN/ECFA-67/WG2/US-SGI/WB-WJ1) Avail: CFSTI

The application of a superconducting bending magnets is recommended as an optical system for an RF separator of 150 GeV/c design momentum. A rough cost estimate for this system is given. It turns out that except for the superconducting bending magnets the cost is comparable to that of a system for lower momenta. The number of elements is almost unchanged and higher gradient but smaller aperture elements are used. Author

N69-18915 European Organization for Nuclear Research, Geneva (Switzerland).
NEED FOR LONG PULSE RF SEPARATORS IN CONJUNCTION WITH 70 AND 300 GeV ACCELERATORS
H. Lengeler *In its* Util. Studies for a 300 GeV Proton Synchrotron, Vol. 2 30 May 1967 p 117–137 refs (See N69-18907 08-11)
(CERN/ECFA-66/WG2/US-SG1/HL-2) Avail: CFSTI

Conclusions were drawn on the utility of DC and RF long pulse separators for counter beams in the momentum region of 4 to 12 GeV/c. The work was extended to counter beams with particle momenta up to 240 GeV/c that will be used in conjunction with a 70 GeV accelerator and a planned European 300 GeV accelerator. Author

N69-18916 Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Experimentelle Kernphysik.
ON THE FEASIBILITY OF SUPERCONDUCTING RF PARTICLE SEPARATORS
W. Juengst *In* CERN Util. Studies for a 300 GeV Proton Synchrotron, Vol. 2 30 May 1967 p 138–145 refs (See N69-18907 08-11)
(CERN/ECFA-66/WG-2/US-SG-1/WJ-1) Avail: CFSTI

Long pulse RF separators are desirable for high energy counter experiments since the acceptance of electrostatic separators becomes too small for particle momenta above 5 to 10 GeV/c and the deflector length becomes impractically long. However, these separators have enormous power requirements. The power dissipation in the RF deflectors can be drastically reduced by the use of superconducting surfaces. Feasibility studies were conducted on producing superconducting materials which have surfaces with high Q values. The question of operating the resonator at a temperature of 1.8°K is considered, along with its separation parameters. B.P.

N69-18917 Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Experimentelle Kernphysik.
ON THE FEASIBILITY OF SUPERCONDUCTING RF PARTICLE SEPARATORS, ADDENDUM
In CERN Util. Studies for a 300 geV Proton Synchrotron, Vol. 2 30 May 1967 p 146–151 (See N69-18907 08-11)
(CERN/ECFA-66/WG2/US-SG1/WJ-A-1) Avail: CFSTI

Additional data and remarks are presented on Q measurements at low temperatures and parametric considerations for the 100 GEV/c kaon, pion, antiproton separator. B.P.

N69-18923 Gt. Brit. National Inst. for Research in Nuclear Science, Chilton. Nimrod Beams Physics Group.
APERTURES AND STRENGTHS OF BEAM TRANSPORT MAGNETS FOR A 300 GeV ACCELERATOR
E. J. N. Wilson *In* CERN Util. Studies for a 300 GeV Proton Synchrotron, Vol. 2 30 May 1967 p 255–277 refs (See N69-18907 08-11)
(CERN/ECFA/66WG2/US/SG1/EJNW1) Avail: CFSTI

It was shown that the coning of production from 300 GeV/c protons is such that it is possible to conceive quadrupole systems which collect 80% of all secondaries produced. The best arrangement of quadrupoles for this purpose is a triplet because of its symmetrical acceptance. Equations are derived for the optimum apertures for iron cored quadrupoles forming such a triplet. The apertures of the majority of subsequent beam elements will be the same. If maximum acceptance is required the triplet will consist of two magnets about five meters long and one about ten meters long at all momenta. But since maximum acceptance will not always be desirable it is preferable to build up to the triplet from modular lengths of one, two, and four meter lengths. The fluxes of secondary particles collected by such a quadrupole system, are much too high for conventional pion, kaon, and antiproton beams for counter experiments and bubble chambers. The fluxes quoted represent an upper limit on beam intensity, and the parameters of magnets suitable for collecting these fluxes will be of importance in determining the scale of the major beam handling elements for more sophisticated experiments. Author

N69-18924 Gt. Brit. National Inst. for Research in Nuclear Science, Chilton.
TRIPLET FOCUSSING SYSTEMS FOR HIGH FLUX SECONDARY BEAMS
E. J. N. Wilson *In* CERN Util. Studies for a 300 GeV Proton Synchrotron, Vol. 2 30 May 1967 p 279–281 refs (See N69-18907 08-11)
(CERN/ECFA/66-WG-2/US/SG1/EJNW3) Avail: CFSTI

A further study is made of using triplet systems for focusing high flux secondary beams. Author

N69-18925 Gt. Brit. National Inst. for Research in Nuclear Science, Chilton. Nimrod Beams Physics Group.

EPB TARGET STATIONS AT 300 GeV

N. M. King and E. J. N. Wilson *In* CERN Util. Studies for a 300 GeV Proton Synchrotron, Vol. 2 30 May 1967 p 283-304 refs (See N69-18907 08-11)

(CERN/ECFA/66/WG2/US-SG5/NMK) Avail: CFSTI

A significant feature of external proton beam (EPB) targeting is the dramatic peaking of secondary products into a cone of small angle about the forward direction. A second significant property of the high energy EPB is the reduction in mean scattering angle on non-interacting protons traversing a given target. The production of high energy muons from the EPB requires extensive shielding. Different basic targeting arrangements were examined critically taking the above considerations into account: several EPB's, use of finite production angle, external beam switching, dispersed secondary images, and achromatic EPB steering. The scheme proposed for the experiment on the basis of this survey is the achromatic target station using sandwich magnets. The problem of providing adequate shielding close to the targets conflicts with the basic requirements of versatility in selecting secondary moments. A possible way in which this difficulty may be ameliorated is recommended using a variable collimator called "The Bacon Slicer." B.P.

N69-18926 Gt. Brit. National Inst. for Research in Nuclear Science, Chilton.

SHIELDING FOR EXPERIMENTAL LAY-OUTS 300 GeV P.S.

R. H. Thomas In CERN Util. Studies for a 300 GeV Proton Synchrotron, Vol. 2 30 May 1967 p 305-310 (See N69-18907 08-11)

(CERN/ECFA/66/WG2/US-SG5/RHT-1) Avail: CFSTI

A study is made of muon shielding downstream of targets for the 300 GeV proton synchrotron. The nature of the background was discussed and it was summarized that transverse shielding thicknesses for beams and back stops will be determined by neutrons but in the extreme forward directions adequate μ-meson shielding must be provided. The general shielding criteria in order of decreasing severity are: (1) experimental requirements as low as one-tenth or even one-hundreth of safe levels; (2) general safe working levels about 1 millirem/hr; and (3) very rare accidental situation never greater than 12 R/hr. Detailed formulas are provided for calculating transverse beam shielding thicknesses and neutron and μ-mesons back stops. B.P.

N69-18930 European Organization for Nuclear Research, Geneva (Switzerland).

THE FEASIBILITY OF A BEAM BY-PASS FOR THE 300 GeV SYNCHROTRON

B. W. Montague *In its* Util. Studies for a 300 GeV Proton Synchrotron, Vol. 2 30 May 1967 p 377-402 refs (See N69-18907 08-11)

(ISR-300/GS/67-1; PS/5748) Avail: CFSTI

The addition of a beam by-pass to the 300 GeV proton synchrotron could extend the experimental facilities and the potentialities of the machine. The advantages of such a by-pass are mentioned. In assessing the feasibility of a by-pass it was necessary to assume that at the time when such a by-pass is designed there will be available superconducting bending magnets of 10 to 20 cm. aperture, 2 m or more in length, with fields up to 5 tesla. The basic geometry, beam dynamics, magnet structure, and beam transfer are considered. It was concluded that there are no fundamental difficulties in building a by-pass for the synchrotron, and that the convenience and flexibility of such a facility will depend on the degree to which it is possible or economic to exploit the potentialities of superconducting magnets. B.P.

N69-18931 European Organization for Nuclear Research, Geneva (Switzerland).

EJECTIONS INTO A 50 AND 100 GeV/c (PRELIMINARY STUDY) [EJECTIONS ENTRE 50 ET 100 GEV/C (ETUDE PRELIMINAIRE)]

A. Laisne *In its* Util. Studies for a 300 GeV Proton Synchrotron, Vol. 2 30 May 1968 p 403-441 refs In FRENCH (See N69-18907 08-11)

(ISR-300/GS/66-39) Avail: CFSTI

A preliminary study was made on the number of ejection possibilities for a primary beam fraction in the intermediary range of 50 to 100 GeV/c. A set-up similar to that proposed for the 300 GeV accelerator was used; the essential difference consisted in employing stationary magnets. Impact trajectories are calculated for fast and slow ejections. Transl. by B.P.

N69-18932 Commissariat a l'Energie Atomique, Saclay (France).

STUDY OF ACCESS AROUND A SYNCHROTRON [ETUDE DES ACCES AUTOUR D'UN SYNCHROTRON]

B. de Sereville and Ph. Tardy-Joubert *In* CERN Util. Studies for a 300 GeV Proton Synchrotron, Vol. 2 30 May 1968 p 442-445 In FRENCH (See N69-18907 08-11)

Avail: CFSTI

The access problems to the tunnel of a synchrotron are enumerated. A schematic drawing is presented of a proposed tunnel on target access consisting of an opening with a simple bend; the efficacy of the trap is discussed. Transl. by B.P.

N69-18933 Commissariat a l'Energie Atomique, Saclay (France).

ELEMENTS FOR THE EVALUATION OF THE PROTECTION AROUND AN EXTERNAL TARGET AT 45 GeV [ELEMENTS POUR L'EVALUATION DE LA PROTECTION AUTOUR D'UNE CIBLE EXTERNE A 45 GeV]

E. Audebex, B. de Sereville, and Ph. Tardy-Joubert *In* CERN Util. Studies for a 300 GeV Proton Synchrotron, Vol. 2 30 May 1968 p 447-458 refs In FRENCH (See N69-18907 08-11)

(CERN/ECFA-66/WG2/US-SG5/ASTJ1) Avail: CFSTI

Calculations were made of energies of strongly interecting particles (muon and neutron fluxes) to determine the amount of protection against radiation needed for personnel and experiments in the operation of a high energy accelerator. A proposed shielding scheme is represented which consists of 2 m of light concrete reinforced with heavy concrete at the target level. Transl. by B.P.

N69-18966*# Virginia Polytechnic Inst., Blacksburg.

PROCEEDINGS OF THE CONFERENCE ON THE ROLE OF SIMULATION IN SPACE TECHNOLOGY, PART A

[1965] 216 p refs Meeting held 17-21 Aug. 1964 *Its* Eng. Extension Ser. Circ. No. 4

(Grant NASr-226)

(NASA-CR-100137) Avail: CFSTI CSCL 14B

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5. MAGNETIC FIELDS: REASONS FOR SIMULATION AND METHODS AVAILABLE N. F. Ness (NASA. Goddard Space Flight Center) 34 p refs (See N69-18971 08-11)

N69-18967*# Aero Vac Corp., Troy, N. Y.
VACUUM TECHNOLOGY
Donald Santeler *In* Va. Polytech. Inst. Proc. of the Conf. on the Role of Simulation in Space Technol., Pt. A [1965] 24 p (See N69-18966 08-11)
Avail: CFSTI CSCL 14B

The basic concepts of vacuum technology are defined, and methods and equipment used to achieve vacuum conditions are discussed. The measurement scales of vacuum pressure, which is defined as any pressure less than standard atmospheric pressure, are described, and the importance of the concept of mean free path in evacuating a confined space to very low pressure is emphasized. An expression is derived for representing molecular flow through an orifice in units of torr liters/sec, followed by a discussion of the effect on gas flow if the orifice is extended to long pipes, since few pieces of vacuum equipment are connected by orifices. Probabilities for use in estimating the flow through complex geometries are also developed, followed by a discussion of the problem of gas leakage in establishing zero pressure. Pumping system and related problems, and vacuum measurement gages are described, as well as the configuration of a typical vacuum system and the factors which influence its cost. The problems involved and methods utilized in simulating the void of space, a value of approximately 10^{-16} torr, are briefly introduced, and the differences and similarities in thin film deposition and high vacuum technology are discussed. A.C.R.

N69-18968*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
ELECTROMAGNETIC RADIATION IN SPACE
Francis J. Clauss *In* Va. Polytech. Inst. Proc. of the Conf. on the Role of Simulation in Space Technol., Pt. A [1965] 58 p refs (See N69-18966 08-11)
Avail: CFSTI CSCL 14B

In general, the aerospace industry simulates electromagnetic radiation for one of three reasons: (1) to evaluate the performance of spacecraft systems that use electromagnetic radiation either as a source of power (e.g., solar cells) or as an information signal (e.g., horizon sensors); (2) to verify the thermal design of a spacecraft or a particular spacecraft system; and (3) to study photochemical effects, such as the photodegradation of spacecraft materials. The three types of application are discussed in detail as well as the techniques used to achieve the desired simulation. An introductory description is included of the character of electromagnetic radiation incident upon satellites and interplanetary space probes, since each type of radiation is important to the thermal balance of the craft; treated are primary, or solar radiation, and secondary radiation, which includes both albedo radiation and planetary emission. A.C.R.

N69-18969*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
IONIZING PARTICLE RADIATION EFFECTS AND SIMULATION CONSIDERATION
J. E. Duberg and W. C. Hulten *In* Va. Polytech. Inst. Proc. of the Conf. on the Role of Simulation in Space Technol., Pt. A [1965] 50 p refs (See N69-18966 08-11)
Avail: CFSTI CSCL 14B

The ionizing radiation environment encountered in space which offers the greatest threat of damage to both manned and unmanned space vehicles is discussed as to its characteristics, effects on various spacecraft equipment and materials, and methods of simulation. This radiation includes protons and electrons trapped in the earth's magnetosphere and high energy protons associated with solar flare events. A discussion of radiation damage mechanisms includes consideration of transient, permanent, surface, and chemical effects. Semiconductor materials, such as those used in solar cells, and transistors; polymers; dielectrics; and transparent materials used in protective shielding of solar power supplies are evaluated as to their performance under the effects of such radiation. The NASA Space Radiation Effects Laboratory simulation facility is described, including its proton and electron accelerators, and beam transport systems, as well as the general arrangement and operation of the laboratory. A.C.R.

N69-18970*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METEOROIDS: NEEDS FOR PENETRATION SCALING LAWS AND THE POTENTIALS OF SIMULATION TECHNIQUES
E. T. Kruszewski *In* Va. Polytech. Inst. Proc. of the Conf. on the Role of Simulation in Space Technol., Pt. A [1965] 36 p refs (See N69-18966 08-11)
Avail: CFSTI CSCL 14B

Earlier empirical formulas for determining penetration and theoretical scaling laws are discussed as applicable to the hypervelocity penetration mechanism of meteoroids in space flight environment. Particular emphasis is placed on high velocity cratering phenomena, particularly the hydrodynamic approach. Accurate meteoroid simulation requires the capability of obtaining impact velocities between 35,000 and 200,000 ft/sec; the ability to ascertain the mass, size, and velocity of the projectile; and the capability of accelerating a large number of smaller particles. The efforts to improve existing facilities to meet these needs are summarized, particularly in the areas of light gas guns and explosive charge accelerators for investigating armor penetration. The conclusions reached in the study are that existing devices are capable of simulating impact only in the lower meteoroid velocity range. A.C.R.

N69-18971*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC FIELDS: REASONS FOR SIMULATION AND METHODS AVAILABLE
Norman F. Ness *In* Va. Polytech. Inst. Proc. of the Conf. on the Role of Simulation in Space Technol., Pt. A [1965] 34 p refs (See N69-18966 08-11)
Avail: CFSTI CSCL 14B

A description is given of the present spatial environment of the earth with respect to magnetic fields as observed by satellite and space probes. The quantitative representation of these fields is also presented, with the conclusion that distortions of the geomagnetic field due to the impact of solar wind restrict altitudes to less than about 4 R_e for accuracies of several percent. Presently available systems for simulating the magnetic fields in space are reviewed, including the facility being built at the Goddard Space Flight Center which incorporates a 25 foot Braunbek coil system employing three separate sets of coils for three axis cancellation of the geomagnetic field. Spacecraft applications of such coil systems are included to illustrate the use of the geomagnetic field in attitude control systems from simple to highly complex applications. The necessity still exists for verifying the operation of these systems at such facilities as that being fabricated at GSFC. A.C.R.

N69-18972*# Virginia Polytechnic Inst., Blacksburg.
PROCEEDINGS OF THE CONFERENCE ON THE ROLE OF SIMULATION IN SPACE TECHNOLOGY, PART B

[1965] 270 p refs Meeting held 17-21 Aug. 1964 *its* Eng. Extension Ser. Circ. No. 4
(Grant NASr-226)
(NASA-CR-100138) Avail: CFSTI CSCL 14B

CONTENTS:

1. HYPERSONIC FLIGHT SIMULATION: AERODYNAMICS J. L. Potter (ARO, Inc., Arnold Air Force Sta.) 60 p refs (See N69-18973 08-11)

2. CONVECTIVE AND RADIATIVE HEAT TRANSFER DURING REENTRY AND ADVANCED TECHNIQUES FOR THEIR SIMULATION T. N. Canning (Va. Polytechnic Inst.) 27 p refs (See N69-18974 08-11)

3. EVALUATION OF MATERIALS IN ENTRY HEATING SIMULATION W. A. Brooks, Jr. (NASA, Langley Res. Center) 44 p refs (See N69-18975 08-11)

4. DETECTION OF, AND COMMUNICATION WITH SPACE VEHICLES DURING ATMOSPHERIC ENTRY; PROBLEMS IN SIMULATION S. C. Lin (Avco-Everett Res. Lab.) 30 p refs (See N69-18976 08-11)

5. FLIGHT REENTRY EXPERIMENTS H. A. Wilson, Jr. (NASA, Langley Res. Center) 26 p (See N69-18977 08-11)

6. BACKGROUND OF PILOTED SIMULATOR DEVELOPMENT C. B. Westbrook (Air Force Sys. Command) 69 p refs (See N69-18978 08-11)

N69-18973*# ARO, Inc., Arnold Air Force Station, Tenn. von Karman Gas Dynamics Facility.
HYPERSONIC FLIGHT SIMULATION: AERODYNAMICS
J. Leith Potter *In* Va. Polytech. Inst. Proc. of the Conf. on the Role of Simulation in Space Technol., Pt. B [1965] 60 p refs (See N69-18972 08-11)
Avail: CFSTI CSCL 14B

An attempt is made to partially assess the current status and direction of laboratory simulation of the aerodynamics of full-scale, hypersonic flight. Problems of simulation related to establishing satisfactory flow fields and the determination of the basic aerodynamic quantities consisting of pressures, forces, and moments, on scale models in these laboratory environments are discussed. In addition, some questions arising in extending scale-model data to full-scale are noted. Author

N69-18974*# Virginia Polytechnic Inst., Blacksburg.
CONVECTIVE AND RADIATIVE HEAT TRANSFER DURING REENTRY AND ADVANCED TECHNIQUES FOR THEIR SIMULATION
Thomas N. Canning *In its* Proc. of the Conf. on the role of Simulation in Space Technol., Pt. B [1965] 27 p refs (See N69-18972 08-11)
Avail: CFSTI CSCL 14B

The evaluation of expected heat loads in reentry situations is considered. These loads are divided into convection and radiation from the gas within the shock layer to the vehicle surface. The use of shock tubes, ballistic ranges, and combinations of the two in simulation of convective and radiative heat loads is described. Specific facilities and equipment for convective and radiative heat transfer measurements are depicted. B.P.

N69-18975*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EVALUATION OF MATERIALS IN ENTRY HEATING SIMULATION
William A. Brooks, Jr. *In* Va. Polytech. Inst. Proc. of the Conf. on the Role of Simulation in Space Technol., Pt. B [1965] 44 p refs (See N69-18972 08-11)
Avail: CFSTI CSCL 14B

The effects of several environmental parameters on the behavior of ablation materials were examined. Practically all the entry heating parameters such as enthalpy, pressure, heating rate, aerodynamic shear, and so forth, affect material performance. However, the significance of the effects depends to a large extent upon the type of material. Inasmuch as it is rarely possible to simulate several environment effects simultaneously, the primary inputs must be determined and the test simulation must account for the effects of these inputs. The particular materials of concern must be characterized by test and analysis to determine which of the many environmental inputs are the most significant. It must also be evident that extrapolation of experimental data to an environment considerably more severe than the test environment can lead to erroneous conclusions. At the present time extrapolation must generally be resorted to for the most advanced entry missions. However, by combining careful characterization of materials in less severe environments with analytical predictions of behavior in the flight environment, one may develop procedures that can result in adequate heat shield designs. Author

N69-18976*# Avco-Everett Research Lab., Everett, Mass.
DETECTION OF, AND COMMUNICATION WITH SPACE VEHICLES DURING ATMOSPHERIC ENTRY; PROBLEMS IN SIMULATION
S. C. Lin *In* Va. Polytech. Inst. Proc. of the Conf. on the Role of Simulation in Space Technol., Pt. B [1965] 30 p refs (See N69-18972 08-11)
Avail: CFSTI CSCL 14B

The physical quantities which govern the absolute intensities of radiation and ionization phenomena in reentry situations are examined. The problem of communication through the optical window of the atmosphere involves the question of absolute spectral emissivity of the high temperature air produced in a hypersonic flow field. A typical set of emission spectra from shock heated air, nitrogen, and oxygen is illustrated. The communication problem through the RF window essentially involves the presence of free electrons, in the high temperature gas. To simulate these two problems involves a simultaneous treatment of the fluid dynamics problem, the chemical kinetics problem, and the problem of propagation of electromagnetic waves in an inhomogeneous hypersonic flow field. For simplicity, the entire simulation problem was divided into three parts: namely, aerodynamic, chemical kinetics and atomic physics, and an electromagnetic simulation. The significant results which were obtained from high temperature shock tube studies in connection with chemical kinetics and atomic physics simulation problem are briefly reviewed. B.P.

N69-18977*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLIGHT REENTRY EXPERIMENTS
Herbert A. Wilson, Jr. *In* Va. Polytech. Inst. Proc. of the Conf. on the Role of Simulation in Space Technol., Pt. B [1965] 26 p (See N69-18972 08-11)
Avail: CFSTI CSCL 14B

A discussion is presented on the way in which flight testing supplements, extends, and reinforces the usefulness of data from ground test facilities. Flight tests can provide an anchor point in evaluating ground test data. Although flight tests can avoid some of the inherent problems of ground facilities, they are expensive, putting a premium on each test to provide the most data that can be acquired. The portions of the reentry flight spectrum which can be simulated by hot and cold ground facilities are reviewed and some of the current flight programs for obtaining data in the Apollo reentry envelope are discussed. The programs are categorized as to: environment (heating), materials response, communication problems, and observables. A discussion of the launch vehicles, unknown parameters, and methods of data acquisition for each program is presented. Author

N69-18978*# Air Force Systems Command, Wright-Patterson AFB, Ohio.
BACKGROUND OF PILOTED SIMULATOR DEVELOPMENT
C. B. Westbrook *In* Va. Polytech. Inst. Proc. of the Conf. on the Role of Simulation in Space Technol., Pt. B [1965] 69 p refs (See N69-18972 08-11)
Avail: CFSTI CSCL 14B

A review is made of the piloted simulation facilities commonly used in the United States. An attempt is made to classify these facilities and to understand how and why these facilities are needed and came into being and how they are used. Some thoughts on the philosophy of use of simulation are offered and conclusions presented. Author

N69-18979*# Virginia Polytechnical Inst., Blacksburg.
PROCEEDINGS OF THE CONFERENCE ON THE ROLE OF SIMULATION IN SPACE TECHNOLOGY, PART C
[1965] 272 p refs Meeting held 17-21 Aug. 1964 *Its* Eng. Extension Ser. Circ. No. 4
(Grant NASr-226)
(NASA-CR-100139) Avail: CFSTI CSCL 14B

CONTENTS:

1. COMPUTERS FOR SIMULATION OF SPACE VEHICLE SYSTEMS R. M. Howe (Michigan Univ.) 21 p refs (See N69-18980 08-11)

2. DISCUSSION OF EXISTING AND PLANNED SIMULATORS FOR SPACE RESEARCH A. W. Vogeley (NASA, Langley Res. Center) 40 p (See N69-18981 08-11)

3. VISUAL AND MOTION SIMULATION TECHNIQUES J. L. Brown (Penn Univ.) 34 p refs (See N69-18982 08-11)

4. DYNAMIC SIMULATORS FOR TEST OF SPACE VEHICLE ATTITUDE CONTROL SYSTEMS G. A. Smith (NASA, Langley Res. Center) 30 p refs (See N69-18983 08-11)

5. INTRODUCTION TO THE SESSION ON STRUCTURAL DYNAMICS I. E. Garrick (NASA, Washington) 2 p (See N69-18984 08-11)

6. PRINCIPLES AND PRACTICES FOR SIMULATION OF STRUCTURAL DYNAMICS OF SPACE VEHICLES G. W. Brooks (NASA, Langley Res. Center) 46 p refs (See N69-18985 08-11)

7. MODELS FOR OBTAINING EFFECTS OF GROUND WINDS ON SPACE VEHICLES ERECTED ON THE LAUNCH PAD W. H. Reed, III (NASA, Langley Res. Center) 56 p refs (See N69-18986 08-11)

8. SIMULATION OF STRUCTURAL DYNAMICS OF SPACE VEHICLES DURING LAUNCH H. L. Runyan (NASA, Langley Res. Center) 40 p refs (See N69-18987 08-11)

N69-18980*# Michigan Univ., Ann Arbor.
COMPUTERS FOR SIMULATION OF SPACE VEHICLE SYSTEMS
R. M. Howe *In* Va. Polytech. Inst. Proc. of the Conf. on the Role of Simulation in Space Technol., Pt. C [1965] 21 p refs (See N69-18979 08-11)
Avail: CFSTI CSCL 14B

Simulation of space vehicle systems by computers can be obtained through all-digital solutions as well as by hybrid computer systems with analog mechanization. It is of utmost importance to choose the appropriate axis systems when writing the optimal equations of motion so that the required computer precision and speed is minimized. Digital computers are more applicable for real time simulation and analog computers for faster than real-time problems, such as trajectory optimization and predictor display studies. Combined analog-to-digital simulation systems seem most useful in optimization and design studies where the speed of the analog and the precision of function-storage capability of the digital can be advantageous. G.G.

N69-18981*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
DISCUSSION OF EXISTING AND PLANNED SIMULATORS FOR SPACE RESEARCH
A. W. Vogeley *In* Va. Polytech. Inst. Proc. of the Conf. on the Role of Simulation in Space Technol., Pt. C [1965] 40 p (See N69-18979 08-11)
Avail: CFSTI CSCL 14B

Discussed are various manned flight simulation programs to provide realistic answers to the human problems of how to manage and control aircraft or space vehicles in an environment which effects man's senses. Sensory inputs in flight simulators as sources of information together with environmental stress inputs are used to study pilot performance during a given task. Generally it is more desirable to have a few special purpose simulators available than a general purpose simulator; the latter is not designed with a special task in view and operates almost all the time at less than maximum efficiency. In certain situations ground-based simulators cannot provide the required fidelity and have to be substituted by flight test simulations that put the pilot in a true flight environment; these situations are generally found in landing and touchdown problems. G.G.

N69-18982*# Pennsylvania Univ., Philadelphia.
VISUAL AND MOTION SIMULATION TECHNIQUES
John Lott Brown *In* Va. Polytech. Inst. Proc. of the Conf. on the role of Simulation in Space Technol., Pt. C [1965] 34 p refs (See N69-18979 08-11)
Avail: CFSTI CSCL 14B

Visual simulation problems are discussed in general terms and the fundamental characteristics of the visual system relevant to simulation techniques are outlined. Emphasis is placed on integration and processing of sensory information by including motion cues in simulators. Only a variable stability aircraft simulator gives a reasonable accurate simulation of a vehicle's motion qualities and its effects on man. Laboratory simulation of linear acceleration components can only be achieved with the aid of centrifuge devices. G.G.

N69-18983*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
DYNAMIC SIMULATORS FOR TEST OF SPACE VEHICLE ATTITUDE CONTROL SYSTEMS
G. Allan Smith *In* Va. Polytech. Inst. Proc. of the Conf. on the role of Simulation in Space Technol., Pt. C [1965] 30 p refs (See N69-18979 08-11)
Avail: CFSTI CSCL 14B

Airbearing supported test platforms are advocated as most satisfactory tools to simulate low friction aspects of the space environment; they permit a representation of spacecraft inertia and a realistic use of the actual vehicle attitude control torque sources and sensors. Designs for airbearing platform test facilities require the following features: isolation in a vacuum chamber and construction of a following gimbal system for attitude readout with its additional use for applying calibration torques to the platform and providing a disturbance free means for connecting electrical wires to the platform. G.G.

N69-18984*# National Aeronautics and Space Administration, Washington, D. C.
INTRODUCTION TO THE SESSION ON STRUCTURAL DYNAMICS
I. E. Garrick *In* Va. Polytech. Inst. Proc. the Conf. on the Role of Simulation in Space Technology, Pt. C [1965] 2 p (See N69-18979 08-11)
Avail: CFSTI CSCL 14B

Mathematical simulation techniques for structural dynamics of space vehicles, launch vehicles, and payloads, on the ground and in space are of utmost importance in aerospace engineering technology. However, the factors of environments have to be included in realistic simulation programs. G.G.

N69-18985*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRINCIPLES AND PRACTICES FOR SIMULATION OF STRUCTURAL DYNAMICS OF SPACE VEHICLES
George W. Brooks *In* Va. Polytech. Inst. Proc. of the Conf. on the Role of Simulation in Space Technol., Pt. C [1965] 48 p refs (See N69-18979 08-11)
Avail: CFSTI CSCL 14B

The paper discusses the philosophy and principles for the selection and design of dynamic models for analysis of structural dynamics of space vehicles. Subjects treated include similitude, model scaling, applications of modeling to launch vehicles and spacecraft, and considerations relative to damping and model support systems. An appendix is included which summarizes the various dimensionless ratios used in aerospace flight. Author

N69-18986*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MODELS FOR OBTAINING EFFECTS OF GROUND WINDS ON SPACE VEHICLES ERECTED ON THE LAUNCH PAD
Wilmer H. Reed, III *In* Va. Polytech. Inst. Proc. of the Conf. on the Role of Simulation in Space Technol., Pt. C [1965] 56 p refs (See N69-18979 08-11)
Avail: CFSTI CSCL 14B

The paper describes how, through simulation with physical and mathematical models, the effects of ground winds on erected launch vehicles are being studied at the NASA, Langley Research Center. Experimental programs include both aeroelastically scaled models in wind tunnels and full-scale vehicles in natural winds. With the aid of a mathematical model having nonlinear aerodynamic damping, insight is gained which helps explain why in some instances the response at supercritical Reynolds numbers is a result of random forced excitation while in other instances is characterized by a self-excited periodic motion. Consideration is also given to the response of erected vehicles to atmospheric turbulence. It is shown that at the fundamental cantilever frequency of Saturn V class vehicles the gust velocities along the vehicle are essentially uncorrelated for separation distances greater than a few vehicle diameters. Calculations indicate that the response is significantly reduced when these spatial correlations of gusts are taken into account. Author

N69-18987*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SIMULATION OF STRUCTURAL DYNAMICS OF SPACE VEHICLES DURING LAUNCH
H. L. Runyan *In* Va. Polytech. Inst. Proc. of the Conf. on the role of Simulation in Space Technol., Pt. C [1965] 40 p refs (See N69-18979 08-11)
Avail: CFSTI CSCL 14B

Simulation techniques for design and operational problems of launch vehicles from the time of lift-off to the time at which the vehicle leaves the sensible atmosphere encompass both, buffet and acoustic load effects. Dynamic models first consider gross vehicle vibratory motion followed by a series of buffeting, and finally noise generated by flow breakdown and separation during transonic and low supersonic flights. The use of reduced scale physical models and the areas requiring full scale tests for the solution of dynamic problems is pointed out. G.G.

N69-18988*# Virginia Polytechnical Inst., Blacksburg.
PROCEEDINGS OF THE CONFERENCE ON THE ROLE OF SIMULATION IN SPACE TECHNOLOGY, PART D
[1965] 236 p refs Meeting held 17-21 Aug. 1964 *In:* Eng. Extension Ser. Circ. No. 4
(Grant NASr-226)
(NASA-CR-100140) Avail: CFSTI CSCL 14B

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3. SENSORY, PERCEPTUAL, AND PHYSIOLOGICAL ASPECTS OF SENSORY DEPRIVATION S. Weinstein (Albert Einstein Coll. of Med.) 26 p refs (See N69-18991 08-04)
4. EFFECT OF LOW-GRAVITY ON PHYSIOLOGICAL PROCESSES S. J. Gerathewohl (NASA, Washington) 36 p refs (See N69-18992 08-04)
5. EFFECTS OF HIGH-GRAVITY ON PHYSIOLOGICAL PERFORMANCE R. M. Chambers (Naval Air Develop. Center) 71 p refs (See N69-18993 08-04)
6. CLOSED ATMOSPHERES G. A. Albright (Republic Aviation Corp.) 64 p refs (See N69-18994 08-04)

N69-18989*# Hughes Aircraft Co., Culver City, Calif.
SIMULATION OF THE STRUCTURAL DYNAMICS OF SPACECRAFT DURING LUNAR LANDING
John M. Bozajian *In* Va. Polytech. Inst. Proc. of the Conf. on the Role of Simulation in Space Technol., Pt. D [1965] 28 p refs (See N69-18988 08-11)
Avail: CFSTI CSCL 14B

Current methods of simulation in development of a landing system for a lunar soft-landing spacecraft are presented, based on the Surveyor, an unmanned lunar spacecraft. A brief general description of Surveyor, its mission, and three-legged configuration are discussed. The functional requirements of the landing system are described with respect to both lunar surface and vehicle touchdown conditions. A landing dynamics computer program has been used to determine toppling stability, and results are shown for a range of lunar surface and spacecraft parameters. Scaling parameters for earth gravity testing are reviewed. Methods for lunar gravity testing are discussed. A lift-force method of gravity simulation was found to be appropriate for Surveyor, and the drop test facility is described in detail. Drop tests of a full-scale dynamic model agree with toppling stability computations. The structural dynamic response of the spacecraft was developed from computer analysis using normal modes from modal vibration tests. Component and structural responses from drop tests of a full-scale structural dynamic model agree with the transient modal analysis. Author

N69-18990*# National Aeronautics and Space Administration, Washington, D. C.
SUMMARY OF REMARKS ON SIMULATION IN AERONAUTICAL AND SPACE TECHNOLOGY
Raymond L. Bisplinghoff *In* Va. Polytech. Inst. Proc. of the Conf. on the Role of Simulation in Space Technol., Pt. D [1965] (See N69-18988 08-11) 9 p
Avail: CFSTI CSCL 14B

The history and the uses of simulation methods, devices, and facilities in science and technology in general, and specifically in aerospace science and technology, are briefly reviewed. K.W.

N69-18995*# Serendipity Associates, Los Altos, Calif.
SST FLIGHT MANAGEMENT SIMULATION STUDIES: EXPERIMENTAL PLAN AND PROCEDURES FOR THE INITIAL STUDY Final Report
Walter B. Gartner Dec. 1968 39 p refs
(Contract NAS2-4406; Proj. I)
(NASA-CR-73302; TR56-68-26(U)) Avail: CFSTI CSCL 14B

The final plan for the execution of a simulation research project concerned with flight management activities during SST low visibility approach and landing operations in civil jet transport aircraft is presented to be used as a detailed guide in the operations. The simulation research study is the first in a series of projects designed to distinguish empirically verified problems in supporting flight management task performance and, subsequently, to develop and test solution concepts. Detailed procedures are presented for implementing the initial study and to define additional simulation facility requirements. Design features of the equipment to be used, including the transport simulator, visual attachment, and data recording instrumentation are described fully. The basic structure of the experimental program is outlined as to the schedule of subject exposure to run variations and experimental conditions, as well as performance measures. Each procedure is then delineated from subject selection, preparation and execution of the simulation sequence, including data analysis and interpretation, to the evaluation of the subject's performance for each designated task. A.C.R.

N69-19014# Institut Franco-Allemand de Recherches, St. Louis (France).
GEOMETRIC DEFINITION OF A LINEAR OR PLANE WAVE GENERATOR. [DEFINITION GEOMETRIQUE D'UN GENERATEUR BIEXPLOSIF D'ONDE PLANE OU LINEAIRE]
M. Defourneaux 21 Nov. 1967 12 p In FRENCH
(ISL-N-24/67) Avail: CFSTI

The geometry of the shock waves obtained from a linear or plane wave generator is discussed. Calculations were made for the separation profiles of the rapid exterior explosion and slow interior explosion taking into account an actual value of the priming time from the relay position of the explosive. Engineering specifications for a shock tube, based on the calculated geometry considerations, are depicted. Transl. by B.P.

N69-19081# Ohio Univ., Athens.
RADIO THEODITE PLACEMENT CRITERIA FOR GLIDE PATH MEASUREMENT Final Report
Richard H. McFarland Jan. 1969 12 p
(FAA Order W1-9-00987-1)
(SRDS-RD-69-4) Avail: Issuing Activity

Some Category II ILS facilities appear to possess paths which exceed the allowable tolerances as defined in FAA order 8200.11A. The intent of this consulting study was to investigate ways for altering the subject paths to within tolerance conditions. Atlanta 09R was selected as the facility for consideration and field demonstration. During the course of investigation, theoretical evidence came to light which questioned the existing theodolite's placement, as defined in the subject order, to be used as the standard placement. The project effort concluded in an exact definition of a standard facility, a redefinition of the theodolite's standard placement and the Atlanta 09R glide path's re-evaluation. Author

N69-19156# Nationaal Lucht-En Ruimtevaartlaboratorium, Amsterdam (Netherlands).
HOT JET SIMULATION FACILITY FOR NRL WIND TUNNELS
[1968] 9 p
(PD-5260) Avail: CFSTI

A comprehensive description is given of an operational system for simulating hot jets of aircraft and rocket models in low speed, transonic and supersonic wind tunnels. Stagnation jet temperatures can be reached, ranging from 250–980°C, while the maximum attainable stagnation jet pressure is 60 kg/cm^2. Author

N69-19158# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.
HIGH CURRENT PULSED ELECTRON ACCELERATOR
E. A. Abramyan et al 1968 11 p refs Transl. into ENGLISH of Inst. of Nucl. Phys., Novosibirsk, Preprint No. 22, 1966
(AERE-Trans-1099) Avail: CFSTI; UK: 2s 6d

The working of a direct-current pulsed accelerator with a Tesla transformer acting as the high-voltage source and the acceleration tube built into the transformer are described. The machine delivers electron currents of hundreds of amperes at energies of several Mev and pulse lengths in the range 10^{-9} to 10^{-5} second. The system permits operation both in single current pulses and at repetition rates of hundreds of cycles a second. An experimental machine (ELIT-1) is described, from which an electron current of 35 A was obtained with 1 MeV energy in pulse lengths of 2 μs and a repetition rate of 10 Hz. With these parameters the mean beam power was 0.7 kW. Author (NSA)

N69-19174# Federal Aviation Administration, Atlantic City, N. J. National Aviation Facilities Experimental Center.
GRAPHIC SIMULATION STUDY OF SITES FOR A THIRD CHICAGO METROPOLITAN AIRPORT Final Report
Sidney B. Rossiter Aug. 1968 73 p refs
(FAA-NA-68-15; FAA-RD-68-41) Avail: Issuing Activity

A graphic simulation study was made of the Chicago terminal area to provide comparisons between two proposed sites for a third Chicago Metropolitan Airport. Terminal area air traffic control procedural plans were developed incorporating each new site. Through the use of a questionnaire, developed around factors that significantly effect an air traffic control subsystem, each site was evaluated by a panel of 12 Air Traffic Control Specialists. The results of this evaluation indicated that Site A was preferred over Site D. The predominant reasons for this choice were the lesser degree of interaction of arrival traffic in the final approach area to the three major airports and the availability of less restrictive airspace to support areas of independent operations. In addition, Site A would permit future expansion of both Site A and O'Hare airports with the least impact on the other. Author

N69-19177# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
ELECTRON LOSSES IN STORAGE RINGS DUE TO PHASE FLUCTUATIONS OF THE RF VOLTAGE
A. Piwinski Sep. 1968 19 p refs
(DESY-68/51) Avail: CFSTI

In electron storage rings it is desirable to have a very small synchronous phase angle. The lower limit of the phase angle is given by the rf power and by phase fluctuations of the rf voltage. The influence of small statistical phase fluctuations of the rf voltage is investigated. Using the Fokker–Planck equation and taking into account the nonlinearity of the synchrotron oscillation, an expression for the energy spread and the lifetime of the stored particles is obtained. Author (NSA)

N69-19221# Princeton-Pennsylvania Accelerator, Princeton, N. J.
ON THE RF BUNCH TIGHTENING
F. Larsen and K. Prelec 22 Oct. 1968 8 p ref
(Contract AT(30-1)-2137)
(TID-24800) Avail: CFSTI

The adiabatic theorem is applied to phase oscillations in a synchrotron for estimating the bunch length (phase amplitude) and energy spread (radial amplitude) during the process of bunch lightening. Total acceptance and adiabatic changes of parameters are also discussed. NSA

N69-19356# National Accelerator Lab., Batavia, Ill.
NATIONAL ACCELERATOR LABORATORY DESIGN REPORT
Jun. 1968 307 p refs
(TID-24773) Avail: CFSTI

After a brief introduction of the purpose and character of the National Accelerator Laboratory, a detailed description of the accelerator is presented. Other topics discussed are the provisions for experimental use, physical plant, costs and schedules and provisions for future expansion. NSA

N69-19357# Institut Franco-Allemand de Recherches, St. Louis (France).
PRESSURE MEASUREMENTS IN A PROTECTIVE CHAMBER FOR AN X-RAY APPARATUS [MESURES DE PRESSIONS DANS UNE CHAMBRE BLINDEE POUR APPAREIL A RAYONS X]
G. Parmentier and M. Froboese 31 May 1967 25 p In FRENCH
(ISL-N-4/67) Avail: CFSTI

A shielded chamber was constructed to protect an X-ray apparatus from shock waves. It has thick walls, a metal frame structure, a layer of glass wool, a partition of foam rubber, and a perforated back plate enclosure. The assembly is mounted on wheels and placed on rails; pictures of the ensemble are included. Pressure measurements were recorded in the chamber interior and on the walls facing the detonation for explosive charges between 88 and 1023 grams. The X-ray tube in the chamber interior underwent no damage during the course of the detonations. Transl. by B.P.

N69-19361# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.
TRANSFORMER BASED HIGH CURRENT ACCELERATOR
E. A. Abramyan et al. 1968 14 p refs Transl. into ENGLISH of Inst. of Nucl. Phys., Novosibirsk, Preprint No. 19, 1966
(AERE-Trans-1098) Avail: CFSTI; UK: 2s 6d

The working principle of a direct-current accelerator designed for accelerating electrons to energies of 1.5 MeV with a mean beam power of some tens of kilowatts and a power conversion efficiency of about 90% is described. The accelerator is essentially a transformer with a core consisting of insulated segments with a built-in acceleration tube; it works from a 50 Hz mains supply and is placed in a medium of compressed gas. In order to ensure constant electron energy the voltage on the tube is stabilized by regulating the current in the tube. The length of electron current pulses can be set from 0 to 5 ms, and the repetition rate at up to 50 per second. The mean current can attain 1/6 of the maximum current per pulse. In order to develop up to 100 mA electron current through the tube in a beam of some mm diameter, magnetic lenses are fitted inside the tube. The shielding of air-gaps and other electrically stressed parts of the accelerator from radiation generated in the tube is ensured by screens of heavy metal, placed near the axis of the tube. A beam of 1.5 MeV energy and 25 kW mean power has been obtained. Author (NSA)

N69-19368# Institut Franco-Allemand de Recherches, St. Louis (France).
ELECTROSTATIC ACCELERATORS, MICROMETEORITE SIMULATORS [LES ACCELERATEURS ELECTROSTATIQUES, SIMULATEURS DE MICROMETEORITES]
A. Charlier 21 Feb. 1967 22 p refs In FRENCH
(ISL-D-1/67) Avail: CFSTI

Electrostatic acceleration of powders was studied in relation to the development of micrometeorite simulators. The theory of particle charge and injection and the equipment used are discussed. Accelerators utilizing intensities of 100 kV, 2 to 6 MV, and 20 MV are compared and discussed as to the advantages and disadvantages of the equipment and the particle speeds reached. The most promising methods for obtaining speeds between 10 and 40 km/s seem to be wire explosion and the Friichtenicht accelerator, which is able to reach speeds of 14 km/s with iron projectiles and 25 km/s with carbon base projectiles. Speeds between 3 and 5 km/s were experimentally reached with iron carbonyl particles. The local irregularities of the projectiles and electrode, reproducibility of the experiment, charge and speed determination, amplitude and intensity duration measurements, and signal amplifiers are described. Transl. by P.A.B.

N69-19381# Federal Aviation Administration, Atlantic City, N. J. National Aviation Facilities Experimental Center.
FLIGHT TEST AND EVALUATION OF HELICOPTER LIGHTING FOR VFR Final Report
Richard L. Sulzer and Thomas H. Paprocki Mar. 1969 102 p refs
(FAA-NA-69-2; FAA-RD-68-61) Avail: Issuing Activity

The overall system included lighting to identify and locate the heliport and support the approach and landing of helicopters. The following conclusions were produced. The heliport beacon, flashing green-yellow-white, had adequate range and distinctiveness but could be improved by a change in flash rate; the yellow pad perimeter lighting met all requirements; the white approach direction and yellow landing direction lighting components were satisfactory; both pad surface floodlighting and pad inset lights were used satisfactorily, and all pilots who were shown the painted maltese cross marking rated it as an aid at night; the lighted wind sock provided adequate wind direction information if overflown first, but neither the lighted wind sock nor the lighted wind tee tested were adequate to provide this information to a pilot on the approach path at one-half mile from the pad. Author

N69-19388# Brookhaven National Lab., Upton, N. Y.
FUTURE OF HIGH ENERGY ACCELERATORS
John P. Blewett [1968] 16 p Presented at 15th IEEE Nucl. Sci. Symp., Montreal, 23–25 Oct. 1968
(BNL-12938) Avail: CFSTI

A review of high energy accelerators which are now in operation is presented. Accelerators under construction are discussed and very high energy machines, still far in the future, are listed and described. Possible uses of cryogenic and superconducting magnets are mentioned. Colliding beam projects in operation and planned are presented. Author (NSA)

N69-19433*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE SCIENCES DIVISION
In its Space Programs Sum. No. 37–54, Vol. 3, Oct.–Nov. 1968 31 Dec. 1968 p 133–170 refs (See N69-19427 08-34)
Avail: CFSTI CSCL 14B

Results of continuing research in the area of space instrumentation, bioscience, and space physics are reported. Development of a wind tunnel capable of simulating meteorological conditions on Mars is discussed. A low noise charge-sensitive

video preamplifier was investigated for use with secondary electron conduction camera tubes, and studies were conducted on methods of alignment for a flight model infrared interferometer. Results of continuing meteoritic sampling of the solar wind are reported, and an experiment for analyzing Martian soil for an unmanned exploration mission is described. Recent observations concerning Jupiter red spot data are reported, including a possible relationship to the solar wind variations. A mathematical analysis of the ion-molecule thermal reaction rate of gas phase reactions I-III is presented. Finally, analysis of the dielectric function of a low density electron gas and new techniques for predicting OH and OD free radical frequencies by analyzing their microwave spectra are included. A.C.R.

N69-19436*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FACILITIES OFFICE
In its Space Programs Sum. No. 37-54, Vol. 3, Oct.-Nov. 1968 31 Dec. 1968 p 239-243 ref (See N69-18427 08-34)
Avail: CFSTI CSCL 14B

Variable optical techniques applied to solar simulators are discussed for a facility capable of producing a uniform (±5%), well collimated (±1 deg) beam of radiant energy on a 15 foot diameter circle within a 25 foot test volume. The brightest available xenon compact arc lamps (20 kw) were used as the radiation source. Design characteristics, possible modifications to the existing configuration, and performance efficiency are included in the discussion. A.C.R.

N69-19562# Massachusetts Inst. of Tech., Cambridge. Engineering Projects Lab.
THE DESIGN AND CONSTRUCTION OF A LOW-NOISE, LOW-TURBULENCE WIND TUNNEL
Carl E. Hanson 13 Jan. 1969 56 p refs
(DSR-79611-1) Avail: Issuing Activity

A low-noise, low-turbulence, subsonic wind tunnel was designed for investigation of both wide and narrow band flow noise processes. The open-circuit design incorporates such innovations as interchangeable open jet and closed duct test sections within a sealed test chamber which can be either reverberant or anechoic by the use of removable wall treatment. Low noise level at the test section is achieved by using upstream treatments such as anechoic wedges off the face of the inlet and a honeycomb of soda straws, and by using downstream treatments such as a combination muffler-diffuser and another honeycomb of soda straws. The design concept, the aerodynamic performance, and the acoustical performance are presented. Author

N69-19575 National Lending Library for Science and Technology, Boston Spa (England).
REGULATIONS FOR THE INSTALLATION OF ELECTRICAL PLANT INDUSTRIAL PREMISES SUBJECT TO EXPLOSION HAZARDS [BESTIMMUNGEN FUER DIE ERRICHTUNG ELEKTRISCHER ANLAGEN IN EXPLOSIONSGEFAEHRDETEN BETRIEBSTAETTEN]
Sep. 1968 28 p refs Transl. into ENGLISH of German Report VDE-0165/4.66
(NLL-SMRE-Trans-5527-(8313.6)) Avail: Natl. Lending Library, Boston Spa, Engl.

Regulations for the installation of electrical equipment in industrial facilities subject to explosive hazards, as defined by the Association of German Electrical Technicians (VDE) are presented. The scope of the regulations and their application to other existing specifications published by the VDE is defined. The regulations include general measures and definition of the types of permitted equipment, as well as specific instructions involving scavenging, intrinsic safety, surface temperature specifications for equipment subject to dust explosive hazards, and protective measures. Such equipment as machines, transformers, capacitors, and resistors are of the type to which these standards apply. Detailed instructions are given for heating and lighting installations, cables and leads, and the equipment used for analysis, control, and testing of the installed facilities. A.C.R.

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N69-18429 Florida Univ., Gainsville.
DYNAMIC RESPONSE OF A WETTING LIQUID ENCLOSED IN A ROTATING TANK IN A ZERO-G ENVIRONMENT AND SUBJECTED TO VARIOUS DISTURBING FORCES
Sui-Kwong Paul Pao (Ph.D. Thesis) 1967 78 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-9483

The exploration of the nature of liquid interface oscillations in a rotating tank and the possibility of rotational stabilization are studied. The system under consideration consists of a right, circular, cylindrical tank of finite length, partly filled with an inviscid, incompressible, wetting liquid. The whole system spins about the tank axis with constant angular speed in a near zero-g environment. The large scale vapor bubble takes a stable equilibrium shape which is similar to an elongated spheroid and located symmetrically about the axis of rotation. When perturbing forces are prevailing, the liquid body and the free interface will oscillate about the equilibrium configuration. The equations of motion are linearized. Surface tension and rotational velocity component are both essential in the treatment of the problem and are taken fully into account. The self-sustained oscillations are governed by an elliptic differential equation for the perturbation pressure field. Dissert. Abstr.

N69-18485# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ACADEMY OF SCIENCES OF THE USSR. NEWS. FLUID AND GAS MECHANICS [AN SSSR. IZVESTIYA. MEKHANIKA ZHIDKOSTI I GAZA]
28 Mar. 1968 23 p refs Transl. into ENGLISH from Russian
(AD-679509; FTD-HT-23-150-68) Avail: CFSTI CSCL 20/4

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1. THREE-DIMENSIONAL SUPERSONIC FLOW PAST A DELTA WING WITH BLUNTED EDGES K. M. Magomedov et al p 1-8 refs (See N69-18486 08-01)

2. NUMERICAL STUDY OF THE THREE-DIMENSIONAL BOUNDARY LAYER IN A COMPRESSIBLE GAS Yu. D. Shevelev p 9-18 refs See N69-18487 08-12)

N69-18487# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NUMERICAL STUDY OF THE THREE-DIMENSIONAL BOUNDARY LAYER IN A COMPRESSIBLE GAS
Yu. D. Shevelev *In its* Acad. of Sci. of the USSR. News. Fluid and Gas Mech. 28 Mar. 1968 p 9-18 refs (See N69-18485 08-12)
Avail: CFSTI

Equations of motion in arbitrary curvilinear space are used to describe spatial laminar boundary layers in a compressible gas. It is shown that the equations can be transformed into a form

analogous to the case of incompressible fluid flow. The method developed earlier by the author is used to descrive the boundary layer flow in the presence of flow separation. If the concepts of zone of dependence and zone of influence is introduced, it is possible to find solutions for the entire flow. This method is applied to the case of an ellipsoid of revolution in a flow with a given angle of attack. The computation using finite difference methods determines the friction and heat flow on the ellipsoid with semi-axis ratios of 1:1.5:1.5, attack angles of 10° and 15°. Other quantities such as enthalpy and velocity are computed and presented graphically. The above example has been worked out for the flows of ideal gas which have the viscosity that depends linearly on the temperature. Author

N69-18503# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genèse (Belgium).

A SINUSOIDAL WAVE GENERATOR FOR DYNAMIC TESTING OF FLUIDIC ANALOG DEVICES

R. N. Gottron and N. E. Miller Aug. 1968 19 p
(VKI-TN-46) Avail: CFSTI

A sinusoidal wave generator capable of producing good quality waves up to 4000 hertz is presented. The design of the generator is given, to include signal generation and signal transmission. The generator is simple to operate and hence, becomes a useful instrument for dynamic testing of fluidic analog devices and systems. In order to achieve the complete frequency range from 10 to 4000 hertz, two generators were constructed. Typical experimental results are presented. The range of pressure amplitudes generated was from 0 to 50 mm of mercury. Author (ESRO)

N69-18504# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genèse (Belgium).

EXPERIMENTAL INVESTIGATION OF A SUPERSONIC AIR-AIR EJECTOR OPERATING WITH A SECOND THROAT

Sheridan C. Johnston Aug. 1968 46 p refs
(VKI-TN-45) Avail: CFSTI

Secondary flow stagnation pressure, second throat step pressure, diffuser wall pressure distribution and performance characteristics have been measured for a supersonic ejector operating with and without a second throat diffuser. Optimum ranges of operation with a second throat diffuser were determined for various ejector configurations. Turbulent flow separation was found to occur upstream of the second throat step for all configurations tested. Reductions of 30% or more in ejector starting pressure were achieved through the use of a second throat diffuser. Author (ESRO)

N69-18505# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genèse (Belgium).

SUPERSONIC SEPARATED FLOWS OVER WEDGES AND FLARES WITH EMPHASIS ON A METHOD OF DETECTING TRANSITION

Jean J. Ginoux Aug. 1968 46 p refs
(Grant AF-EOAR-67-51)
(VKI-TN-47) Avail: CFSTI

The present investigation is a first step to the study of the effect of cross flow in laminar separation at supersonic speeds. It is related to the selection of a final axi-symmetric model. Several problems were examined. First, the effect of streamwise vortices that develop systematically in laminar reattaching flows, triggered by small irregularities in the leading edge thickness. Second, the choice of the diameter of the model such that the flow resembles that on an equivalent planar body, third the programming of Lees-Reeves theory on a 1130 IBM computer to perform a parametric study and finally the development of a new accurate technique or criteria to ascertain that fully laminar shock wave boundary layer interactions can be obtained. Author (ESRO)

N69-18508# Aeronautical Research Council (Gt. Brit.) Fluid Motion Sub-Committee.

FLOW IN A SUPERSONIC JET EXPANDING FROM A CONVERGENT NOZZLE

J. C. Gibbings (Liverpool Univ.), J. Ingham (Modern Metals Ltd.), and D. Johnson (Admiralty Res. Lab.) 11 Jul 1968 33 p refs
(ARC-30371) Avail: CFSTI

Various characteristics of a very uniform sonic jet of air that expands into a stationary atmosphere are determined experimentally and compared with a simple analysis and with existing analytical results. Comparison of the analysis is made with existing results of characteristic calculations.

N69-18549# Aeronautical Research Council (Gt. Brit.)

MEASUREMENTS OF SECONDARY FLOW IN THE BOUNDARY LAYERS OF A 180 DEGREE CHANNEL

V. C. Patel (Cambridge Univ.) Aug. 1968 23 p ref
(ARC-30428) Avail: CFSTI

Secondary flow measurements have been made within the turbulent boundary layers at two streamwise cross-sections of a 180 degree curved channel. The results indicate substantial three-dimensionality on all four walls of the channel. The secondary flows on the flat and convex surfaces are in accordance with those expected from considerations of the action of the centrifugal pressure gradients on the flat surfaces, while those on the concave surface appear to be dictated both by this effect as well as by the occurrence of longitudinal instability vortices. Some attempts have been made to reduce the cross-flows on the curved surfaces so that the influence of streamwise surface curvature on nominally two-dimensional turbulent boundary layers can be investigated. Author (ESRO)

N69-18571 State Univ. of Iowa, Iowa City.

UNSTEADY FLOW IN THE ENTRANCE REGION OF A CIRCULAR TUBE

Xavier Jayaseela Rao Avula (Ph.D. Thesis) 1968 152 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-10448

The problem of unsteady, laminar flow of a viscous, incompressible fluid in the entrance region of a circular tube was treated analytically and experimentally. In particular, the motion of a fluid initially at rest and rapidly set in motion under a constant head was considered. The objectives of the investigation were to determine the boundary layer thicknesses, velocity profiles and instantaneous entrance lengths. A physical model consisting of a growing boundary layer with a parabolic velocity profile and an accelerating irrotational core in the central portion of the tube was assumed. And, the governing equation was derived by applying the general integral momentum equation to a fluid element in the entrance region. The governing equation, which was a first order quasi-linear partial differential equation, was reduced by the method of characteristics to a system of three ordinary differential equations, and these equations were solved numerically. The special case for which the discharge was a constant was solved in a closed form and was used to verify the computer program. Dissert. Abstr.

N69-18580 Cornell Univ., Ithaca, N. Y.

VARIATIONAL QUANTIZED VORTEX FLOWS IN LIQUID HELIUM

Roger Nathan Metz (Ph.D. Thesis) 1968 146 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-9444

This paper gives a variational calculation of the energy of a vortex line, starting from an excited state trial wave function which contains a model of the core and a proper description of the fluid at large distances. The one-particle distribution functions which naturally arise in the energy functional are calculated numerically from Percus-Yevick and convolution-hypernetted chain type integral equations in analogy with the classical analysis. The calculations are done for three special classes of trial functions, and the lowest energy for its accompanying density profile are determined. These results are then applied to the vortex ring geometry in a large ring approximation. The equation of Bose-Einstein condensation is discussed in the context of a Jastrow approximation to the ground state wave function, which allows a factorization of the single particle density matrix at large distances. The shape of the "macroscopically occupied" state function is obtained, and a discussion of the additional density of condensed particles due to the presence of the vortex is given. Dissert. Abstr.

N69-18692# Max-Planck-Institut für Physik und Astrophysik, Munich (West Germany)
OPTICAL INVESTIGATIONS OF METAL PARTICLES FROM NOZZLE FLOW INTO A VACUUM [OPTISCHE UNTERSUCHUNGEN AN METALLISCHEN PARTIKELN AUS DÜSENSTRÖMUNGEN INS VAKUUM]
C. Batalli-Cosmovici May 1968 112 p refs In GERMAN
(MPI-PAE/Extraterr-12-68) Avail: CFSTI

The high altitude emission of barium clouds has been simulated in a vacuum chamber by burning a barium-copper oxide mixture and studying the two-phase flow into a vacuum in order to optimize barium exploitation and determine the initial conditions in a barium cloud. The following quantities were measured : color and black body temperature at the nozzle outlet: the emission and absorption spectrum: the shape, duration and speed camera; the size distribution of the particles. From these measurements, conclusions were drawn as to the combustion time, the exhaust angle, and the particle size distribution during the exhaust period. ESRO

N69-18712# Commissariat à l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucléaires.
STUDIES ON HOT WIRE AND HOT FILM UNDER WATER [ETUDES SUR LE FIL CHAUD ET LE FILM CHAUD DANS L'EAU]
Francois Resch Jun. 1968 78 p refs In FRENCH; ENGLISH summary
(CEA-R-3510) Avail: CFSTI

This study concerns some problems in the use of a hot wire and a hot film immersed in water. The sensitivity and calibration of hot wires are considered and a specially designed water blower and measurement apparatus are described. Different wires and films were calibrated against velocity and temperature. Turbulence and energy distribution measurements in the centre of the tube are in good agreement with those already carried out in air. Author (ESRO)

N69-18746# Laboratoire de Recherches Balistiques et Aérodynamiques, Vernon (France).
THE FREQUENCY SPECTRA OF SLOSHING LIQUIDS [LE PROBLEME DU BALLOTTEMENT DES LIQUIDES AU POINT DE VUE SPECTRE DES FREQUENCES]
M. Boudet 2 May 1968 47 p refs In FRENCH Suppl. to N.T. 41/64/EN
(NT-46/68/EN) Avail: CFSTI

Results of a classical mathematics physics study of the pulses and other characteristics of sloshing in a tank are presented. The Ritz-Galerkin process, used to solve this problem is discussed and inferences drawn regarding the pendular sloshing of liquids in a cylindrical tank subjected to lateral oscillations and rotation. Author (ESRO)

N69-18776# Aeronautical Research Council (Gt. Brit.)
THE EFFECTS OF CURVATURE ON THE TURBULENT BOUNDARY LAYER
V. C. Patel (Cambridge Univ.) Aug. 1968 60 p refs
(ARC-30427) Avail: CFSTI

Preliminary measurements in the turbulent boundary layers on a circular cylinder and the convex wall of a 90 degree curved duct are described. The results indicate quite significant effects of longitudinal surface curvature on the development of the boundary layer. In particular it is shown that curvature has a marked influence on the velocity profiles, the usual momentum integral equation for flat surface flow breaks down in the presence of large static pressure variations across the boundary layer, and none of the existing boundary layer calculation methods adequately predicts the development of the shape factor. A more general momentum integral equation has been derived from first principles. This gives reasonable agreement with the experimental development of the momentum thickness. Author (ESRO)

N69-18833# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
DETERMINATION BY THE METHOD OF THE CHARACTERISTICS OF THE STEADY SUPERSONIC FLOW AROUND A PROFILE OR AROUND A BODY OF REVOLUTION [CALCUL D'ECOULEMENTS SUPERSONIQUES PERMANENTS AUTOUR DE PROFILS OU DE CORPS DE REVOLUTION AVEC OU SANS INCIDENCE, PAR LA METHODE DES CARACTERISTIQUES]
Pierre Diringer and Pierre Laval 1968 135 p In FRENCH; ENGLISH summary
(ONERA-NT-126) Avail: CFSTI

Detailed determination of the iso-energetic, steady supersonic flow of a gas in chemical equilibrium around a profile or around an axisymmetric body is made by the method of characteristics. The semi-linearized characteristics method is used in the case of a low angle-of-attack. The programs for a 704 I.B.M. computer cover the flow of perfect and real gases (air) in equilibrium in the case of a zero angle-of-attack and the perfect gases in the case of a non-zero angle-of-attack. The results presented underline the possibilities and the precision of the calculation as well as the diversified applications. Author (ESRO)

N69-18840# California Univ., Berkeley. Aeronautical Sciences Div.
AN EXPERIMENTAL STUDY OF A STRATIFIED FREE SHEAR LAYER
Richard S. Scotti (Ph.D. Thesis) Jan. 1969 165 p refs
(Contract USCDE-22-129-68(G))
(AS-69-1) Avail: CFSTI

A statically stable stratified free shear layer was formed within the test section of a wind tunnel by merging two uniform streams of air of different temperature at the entrance to the contraction section. The resulting diffusion-thickened interface was characterized by nearly self-similar temperature, velocity, and Richardson number, J, profiles, adjustable over the range $0.07 \leq J \leq 0.76$ and Reynolds number, Re, over the range $50 \leq Re \leq 150$. Small periodic disturbances were imposed on the interface by oscillating a taut 0.004 inch diameter steel wire within the

interface in the contraction section and subsequent development was deduced from measurements of fluctuating temperature downstream. Results indicate complete infinitesimal stability for J > 1/4 and instability over a range of non-dimensional wave numbers of the order of unity for smaller values of J. Growth rates are presented which agree reasonably well with theoretical predictions based on the assumption of inviscid parallel flow. Author

N69-18843# Svenska Flygmotor A.B. Trollhattan (Sweden). Aerodynamics Div.
METHOD FOR GASDYNAMIC DESIGN OF SHORT WIND TUNNEL NOZZLES CONSIDERING REAL GAS PROPERTIES
Gösta Rosander Nov. 1966 53 p refs
(LA-67) Avail: CFSTI

A summary is given of methods and results from work made on real gas nozzle design methods from August 1961 to June 1966. The main objective of the investigation was to find a method suitable for the design of short high temperature wind tunnel nozzles together with a study of the properties of the resulting flow fields. The report covers the essentials of the applied design methods, results for a Mach 5 test case nozzle used to check the methods, a study of the effect of the test gas thermodynamic properties on the test section conditions and finally a comparison with a different nozzle design method for slender nozzles which is known to produce good flow quality in practice. In all cases the degree of physical consistency of the flow field was checked by an independent method based on the global continuity equation. Author (ESRO)

N69-18905*# Techtran Corp., Glen Burnie, Md.
SPECTRUM OF CORRELATION FUNCTIONS OF TURBULENT FLOW NEAR A ROUGH WALL [O SPEKTRE KORRELYATSIONNYKH FUNKTSIY TURBULENTNOGO TECHENIYA VBLIZI SHEROKHOVATOY STENKI]
V. S. Nishchuk Washington NASA Mar. 1969 refs Transl. into ENGLISH from Gidrodinam. Bol'shikh Skorostei (Kiev), no. 5, 1968 p 143–147
(Contract NASw-1695)
(NASA-TT-F-12130) Avail: CFSTI CSCL 20D

The spectrum of correlation functions for instantaneous velocities in a steady turbulent flow near a rough wall of a channel of rectangular cross-section is investigated. The energy profile of the small-and large-scale eddies through the flow is analyzed. The pulsation energy, the scale of which is equal to the flow thickness and which predominates through the entire thickness of the turbulent core, is found to approach zero near the wall. Author

N69-18997 Wisconsin Univ., Madison.
HYSTERESIS AND TIME-SCALE INVARIANCE IN A GLASS-BEAD MEDIUM
Steven James Bomba (Ph.D. Thesis) 1968 116 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-7089

The adequacy of macroscopic theories of porous media was tested on a very clean system composed of glass beads, water, and air. Measurements of hysteresis in the moisture characteristics and hydraulic conductivity were extended to comprehensive sets of secondary and tertiary scanning curves. The generalized independent domain theory was found to be in a reasonably good agreement with these measurements. The dependence of hydraulic conductivity upon saturation showed very little hysteresis. Transient outflow behavior following a step change of pressure was also explored. Such transient flows were observed both with and without the presence of entrapped air bubbles in the medium. A slow time-constant change of the saturation was shown to be caused solely by the gradual diffusion of air through water into entrapped air bubbles. Comparing the direct measurement of the hydraulic conductivity with the value computed from the transient data, it was possible to estimate the effective membrane impedance. For high saturation, this impedance was found to be about 4 1/2 times higher than that of a fresh membrane. With decreasing saturation, this impedance exhibited a several-fold further increase. Dissert. Abstr.

N69-19015# Institut Franco-Allemand de Recherches, St. Louis (France).
STUDY OF HYPERSONIC WAKES AT ISL [L'ETUDE DES SILLAGES HYPERSONIQUES A L'ISL]
J. Luneau and M. Laug 28 Apr. 1967 16 p refs In FRENCH
(ISL-N-3/67) Avail: CFSTI

The characteristics and nature of a wake produced behind an engine traveling at hypersonic speeds are studied, particularly, the dissociation, ionization, and relaxation effects of real gases, the laws of turbulent diffusion, and the combustion of ablation products in the wake. A brief survey is included on methods of studying hypersonic wakes and the results obtained from these experiments. Visualization methods of researching mechanical wakes and methods of measuring electron density and collision frequency of plasmas in ionizing wakes are reviewed. Transl. by B.P.

N69-19016# Institut Franco-Allemand de Recherches, St. Louis (France).
IMPROVEMENT OF SHADOWGRAPHS BY THE PRESENCE OF ABLATION MATERIALS [AMELIORATION DES OMBROGRAPHIES PAR LA PRESENCE DES PRODUITS D'ABLATION]
J. Vauvrecy 15 Nov. 1967 16 p In FRENCH
(ISL-N-23/67) Avail: CFSTI

The behavior of a wake of spherical projectile launched at hypersonic speed is optically recorded using shadowgraph techniques. Plastic and metal models were launched by a light gas gun and guided by sabots into a wind tunnel at 5000 m/s. A comparison was made of the ablation effects of the two mockups. It was concluded that the principal effect of ablation is to improve the shadowgraphs of the base flow and the near wake; the geometric characteristics of the flow were not changed by ablation. Transl. by B.P.

N69-19060# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
SUPERSONIC TURBULENT MIXING. 1: LITERATURE SURVEY AND ASSESSMENT OF THE STATE OF THE ART
D. Azzouz and N. H. Pratt May 1968 71 p refs
(AASU-281) Avail: CFSTI

A general review is given of the principal theories and methods developed to model the flow of turbulent mixing gas streams. A brief account of the pertinent experimental investigations in the field is also included. Author

N69-19112*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
LATERAL SLOSHING IN CYLINDER UNDER LOW-GRAVITY CONDITIONS
Jack A. Salzman and William J. Masica Washington Feb. 1969 35 p refs
(NASA-TN-D-5058) Avail: CFSTI CSCL 20D

An experimental investigation was conducted to determine liquid sloshing characteristics in cylinders with hemispherical bottoms under low Bond number conditions. Static contact angles were

restricted to near 0° so that the equilibrium liquid surface was nearly hemispherical at very low Bond numbers. The experiments were conducted in both normal and low gravity environments. Data were obtained at Bond numbers ranging from 0 to greater than 800. The natural frequency and damping of the fundamental asymmetric sloshing mode at deep liquid depths were correlated in terms of known system parameters. The natural frequency data at shallow liquid depths were compared with existing theoretical studies. All results were compared with previous normal gravity experimental sloshing studies. Author

N69-19206# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
RADIOISOTOPE TRANSPORT AND DEPOSITION IN FLOWING SODIUM
W. F. Brehm, E. A. Kovacevich, and D. W. Shannon 22 Oct. 1968 15 p refs Presented at Conf. on Sodium Technol. and Large Fast Reactor Design, Argonne, Ill.
(Contract AT(45-1)-1830)
(BNWL-SA-2168; CONF-681106-2) Avail: CFSTI

Transport and deposition of radioisotopes released to flowing sodium from corrosion of irradiated stainless steel are studied. Quantitative measurements of deposition can be made with sensitive counting techniques. The results indicate that ^{51}Cr and ^{60}Co are transported primarily by isotopic exchange, and do not rapidly migrate to lower temperature regions of loop systems. However, ^{54}Mn is released in larger quantities to deposit throughout the test loops. Preferential deposition sites are immediately downstream from the source, at minimum temperature locations, and in oxygen cold traps. These results indicate ^{54}Mn is transported both by exchange and by solution-and-precipitation. Deposited ^{54}Mn migrated rapidly to the cold trap, deposited ^{51}Cr and ^{60}Co migrated slowly by exchange. Author (NSA)

N69-19342*# Pennsylvania State Univ., University Park. Dept. of Electrical Engineering.
MOLECULAR FLOW THROUGH MEMBRANES
R. E. Pulfrey 10 Nov. 1968 74 p refs
(Grant NGR-39-009-032)
(NASA-CR-100252; SR-326) Avail: CFSTI CSCL 20D

The use of the theory of molecular flow for the analysis of vacuum networks was demonstrated. The highest pressures for which molecular flow is maintained through a membrane were experimentally determined for various isotopically pure gases; two different membrane types were tested. Results are presented of experiments with a simple molecular flow network, and it is shown that the experimental method is extremely accurate for measuring the absolute conductance of a membrane for molecular gas flow. A vacuum network for the analysis of a gas mixture is optimized by variation in effusion rates of the constituents of the mixture. Advantages, limitations, and the expected accuracy of such a method of gas mixture analysis are discussed. Numerical methods for increasing the accuracy of the technique are presented. K.W.

N69-19355# Institut Franco-Allemand de Recherches, St. Louis (France).
ENTROPY WAKE BEHIND A SPHERE IN HYPERSONIC FLIGHT [SUR LE SILLAGE D'ENTROPIE DERRIERE UNE SPHERE EN VOL HYPERSONIQUE]
J. Nuyts 18 Dec. 1967 17 p refs In FRENCH
(ISL-N-29/67) Avail: CFSTI

The existence of an entropy wake behind spheres traveling at hypersonic speed is calculated; it is visible through streak photography; and it hinders the observation of the internal viscous wake, particularly the location of the transition toward the turbulent region. The diameter of the entropy wake is shown to increase with Mach number, the entropy which determines these boundaries decreases with the diameter of the projectile and depends little on the Mach number. The definition proposed for the diameter of the entropy wake is not arbitrary, but agrees with measured values. A calculation of the density differential in the wake permits a relation between this quantity and the sensitivity of the schlieren photographs. Transl. by B.P.

N69-19356 Institut Franco-Allemand de Recherches, St. Louis (France).
FLOW VISUALIZATION BY SCHLIEREN PHOTOGRAPHY OF THE TRANSITION BEHIND A SPHERE IN HYPERSONIC FLIGHT [ESSAI DE VISUALISATION PAR STRIOSCOPIE DE LA TRANSITION DERRIERE UNE SPHERE EN VOL HYPERSONIQUE]
P. Smigielski 12 Dec. 1967 10 p refs In FRENCH
(ISL-N-26/67) Avail: CFSTI

Schlieren photographs were made of the wake of a spherical projectile of 9.65 mm diameter travelling at a speed of about 2700 m/s and a pressure of 15 mm of Hg. The spheres were fired without using sabots and the shock wave reflection from the walls of the tunnel do not influence the wake. The different streak photographs show the direction of the wake between 0 and 400 calibers. At 160 calibers, turbulence is visible; between 0 and 160 calibers the photographs show a wake of constant diameter (equal to around 3 calibers) which is apparently laminar. This transition was hypothesized to be an entropy wake. Transl. by B.P.

N69-19371# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
TWO PHASE FLOW AND HEAT TRANSFER IN MULTIROD GEOMETRIES Quarterly Progress Report, 1 Apr.–30 Jun. 1968
Aug. 1968 22 p refs
(Contract AT(04-3)-189)
GEAP-5679; QPR-11)

A description of the relationship between the mean liquid film flow rate and the mean liquid film thickness for annular adiabatic two-phase flow is presented. Data are presented for different fluids and different geometries. Good agreement is established for the G^2 versus δ^2 relationship for pressures of 1 atm $< P <$ 22 atm, $0.05 < x < 0.74$, and mass flow rates between 0.1×10^6 and 2×10^6 lb/hr ft^2. Analysis using mixing length theory with void allowance is in agreement with the data. A comparison of the data indicates the Levy model for liquid film thickness is relatively insensitive to the film liquid flow rate. NSA

N69-19450# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
MEASUREMENTS OF BUBBLE DENSITIES IN LIQUID HYDROGEN AND LIQUID DEUTERIUM
G. Horlitz, S. Wolff, and G. Harigel Aug. 1968 14 p refs
(DESY-68/45) Avail: CFSTI

Bubble densities have been measured on tracks of electrons of about 2 GeV/c in an 85 cm bubble chamber. The chamber was either filled with liquid hydrogen or with liquid deuterium. The measuring procedure including the measurement of all parameters as well as the evaluation of the data is described. Measurements have been made in large temperature and pressure intervals. Points of equal bubble density in a p-T-diagram have been fitted to parabolas through the critical point. Author (NSA)

N69-19461# Oak Ridge National Lab., Tenn.
PEAK OVERPRESSURE AT THE FOOT OF A VERTICAL WALL FACING AN AIR BLAST

Lawrence Dresner 19 Sep. 1968 18 p refs
(Contract W-7405-ENG-26; ARPA Order 907; Proj. Civil Defense Res.)
(ORNL-TM-2362) Avail: CFSTI

Practical results for the pressure amplification in the right angle between two planes can be obtained by combining the known solutions of the problems of oblique and normal shock reflection. The results so obtained have been checked for various shock strengths and two angles of incidence by experiments carried out in an explosively driven shock tube. Author

N69-19514# Canadian Armament Research and Development Establishment, Valcartier (Quebec). Defence Research Board.
EXPERIMENTAL STUDY OF TURBULENT WAKES IN FREE-FLIGHT RANGES
D. Heckman, L. Tardif, and C. Lahaye Sep. 1968 57 p refs
Presented at Symp. on Turbulence of Fluids and Plasma, Brooklyn, 16-18 Apr. 1968
(Contract DA-01-021-AMC-14468(Z); ARPA Order 133; Proj. Defender)
(CARDE-TR-595/68) Avail: CFSTI

Experiments being undertaken to investigate both the mean and fluctuating properties of turbulent wakes are described. The diagnostic techniques which are used to make local measurements in the wake utilize an electron beam fluorescence probe, sequential spark velocity apparatus, cooled-film anemometers, and electrostatic probe arrays. These provide measures of mass density, velocity, temperature and charge density fluctuations, as well as the means for inferring some properties of the wake turbulence. In each case some typical results are used to illustrate the capability of the techniques. Some comparisons are made between the results obtained by different experiments. Author

N69-19651# McDonnell-Douglas Co., Santa Monica, Calif. Physical Sciences Dept.
STRONG FLOWING ACROSS A COUETTE-POISEUILLE SHEAR FLOW
George R. Inger Dec. 1968 17 p refs
(DAC-62429) Avail: Issuing Activity

A theoretical study of mass injection into laminar viscous flows is made using an idealized Couette-Poiseuille shear flow model. Emphasis is placed on an examination of the massive blowing regime. Closed-form solutions are obtained in a unified form applicable to either two-dimensional or axisymmetric flow including heat transfer and the effects of both axial and blowing-induced lateral pressure gradients. The analysis shows that shear layer blowoff from the blown surface occurs for sufficiently strong injection and that its onset is appreciably delayed by three-dimensional relief effects. The flow in this asymptotic regime has a two-layered structure whose basic character depends critically on whether or not an axial pressure gradient is present. The flow work effect of the blowing-induced lateral pressure gradients is also shown to influence the structure of the temperature field if the injection kinetic energy is sufficiently large. Author

N69-19516# California Univ., Livermore. Lawrence Radiation Lab.
THE FLIP CODE: FLUID INJECTION PROGRAM
J. A. Korver 15 Oct. 1968 32 p ref
(UCRL-50508) Avail: CFSTI

The FLIP code is a computer-program solution to the time-dependent flow of an incompressible fluid from large diameter wells into unsaturated, confined formations. A continuous succession of steady-state solutions is used to predict the nonsteady flow behavior in time and space. With reasonable assumptions for the initial conditions, running times for problems of interest can be as short as 5 to 10 seconds. Author (NSA)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N69-18487 Saskatchewan Univ., Saskatoon.
POLARIZATION OF UHF RADAR AURORAL ECHOES AND REFLECTION MECHANISMS
Subrahmanya Ramnath (Ph.D. Thesis) 1968 167 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-9728

The polarization parameters were determined by a radar with 2Mw peak power transmitting linearly polarized waves at 448 MHz with pulse width of 1.0 millisecond and a repetition rate of 30 pulses per second. It was found that the polarization parameters fluctuate from pulse to pulse, and that the cross polarization of the echoes has values ranging from 6 to 18 db. The echoes appear to be completely polarized. The polarization ellipse has alternately either sense of rotation. A study is made by phenomenologically describing the anisotropy of the scattering medium by a general polarizability tensor. It is shown that the principal axes of the medium at all spatial locations may be formed by the radar beam and two coordinates normal to the beam, rotating in opposite directions. Auroral echoes are treated as Brillouin scattering in the ionosphere. This scattering is attributed to the interaction of the incident waves with favourable ion acoustic waves. It is shown that the incident and the ion acoustic waves would have to be collinear for backscattering. The observed polarization characteristics of auroral echoes are explained on the basis of this scattering mechanism. Some multiple frequency experiments are suggested for further verification of the scattering model. Dissert. Abstr.

N69-18478# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MOSCOW. SCIENTIFIC RESEARCH INSTITUTE OF AEROCLIMATOLOGY. TRANSACTIONS Selected Articles
15 Mar. 1968 37 p refs Transl. into ENGLISH from Tr. Naucha. Issled. Inst. Aeroklimatologii (Moscow), No. 24, 1963 p 7-17, 54-58, 61-65
(AD-679938; FTD-HT-23-99-68) Avail: CFSTI CSCL 4/2

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3. A COMPARISON OF THE TEMPERATURE, PRESSURE, AND DENSITY OF THE TENTATIVE STANDARD ATMOSPHERE (TSA) WITH THE CORRESPONDING DATA ON THE NORTHERN HEMISPHERE AND 30° LATITUDE BELTS Z. I. Gavrilova p 25-31 refs (See N69-18481 08-13)

N69-18479# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD OF CALCULATING THE TENTATIVE STANDARD ATMOSPHERE (TSA)

Z. I. Gavrilova *In its* Moscow. Sci. Res. Inst. of Aeroclimatol. Trans. 15 Mar. 1968 p 1–16 (See N69-18478 08-13)
Avail: CFSTI

The author derives the basic formulas according to which the calculation of the tentative standard atmosphere was derived. The model of the tentative standard atmosphere was calculated up to 200 geometric km according to the values of the kinetic air temperature at reference altitudes assigned on the basis of preliminary processing. The various data of the reference altitudes, together with the temperatures in degrees Kelvin, are presented in tables. Also presented in tables are the gradients of molecular temperature in °K/geopotential km, the temperature gradient in 0°C/geopotential km, the molecular weight at the reference altitudes, the atmospheric pressure at the reference altitudes, and the values of the constants. atmospheric density at the reference altitudes. Formulas are given from which the atmospheric density, atmospheric viscosity, acceleration of the force of gravity, and the length of a free path of molecules were derived. Author

N69-18480# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEAN AND EXTREME PRESSURE VALUES
O. B. Mertsalova et al *In its* Moscow. Sci. Res. Inst. of Aeroclimatol. Trans. 15 Mar. 1968 p 17–24 refs (See N69-18478 08-13)
Avail: CFSTI

The authors describe a method of calculating mean pressure distribution at altitudes for three latitude belts and for the entire northern hemisphere as well as a method of obtaining extreme pressure values. The three latitude belts are the tropic (0–30°NL), temperature (30–60°NL), and polar (60–90°NL). The number of observations used for determining mean altitudes is the same as for temperature. The values of the extreme air pressure in the northern hemisphere and the mean annual air pressure is plotted. The differences of seasonal mean pressures are presented in tables for the three zones, as well as for the northern hemisphere as a whole. Author

N69-18481# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A COMPARISON OF THE TEMPERATURE, PRESSURE, AND DENSITY OF THE TENTATIVE STANDARD ATMOSPHERE (TSA) WITH THE CORRESPONDING DATA ON THE NORTHERN HEMISPHERE AND 30 DEG LATITUDE BELTS
Z. I. Gavrilova *In its* Moscow. Sci. Res. Inst. of Aeroclimatol. Trans. 15 Mar. 1968 p 25–31 refs (See N69-18478 08-13)
Avail: CFSTI

The author makes the comparisons noted in the title as well as the relative deviations of temperature pressure and density which are presented in tables. He considers that in the construction of a new model of a standard atmosphere, more accuracy is necessary in the temperature curve in the layer of 0.30 km. Multiyear annual pressure and density for the northern hemisphere and the belt of 30–60° NL is the nearest to the pressure and density of the tentative standard atmosphere. The relative deviations of pressure and density for the belts 0–30 and 60–90°NL are considerably more. As could be expected, changes with an altitude of relative deviations of density and temperature are opposite in sign and their curves have a mirror image. The relative deviations of pressure for the northern hemisphere and the belt of 30–60°NL is comparatively small in the layer of 0/30 km. For the belts of 0–30 and 60–90°NL, the greatest comparative deviations of pressure are noted at altitudes of 9–13 km. Author

N69-18488*# Hawaii Univ., Honolulu. Inst. of Geophysics.
A STUDY OF THE DEGREE TO WHICH SATELLITE-DERIVED GRAVITATIONAL DATA CAN BE RELATED TO THE ANOMALOUS SURFACE GRAVITY FIELD AND OTHER ANOMALOUS GEOPHYSICAL PARAMETERS Final Report
George P. Woollard, Mohammad Asadullah Khan, and Simo Lauria Jan. 1969 127 p refs
(Grant NGR-12-001-045)
(NASA-CR-99764) Avail: CFSTI CSCL 08N

The technique of frequency analysis for two-dimensional data was adapted to geophysical problems and used to analyze the anomalous gravity field of the Solomon Islands area. This region was selected for testing the analytical procedure because there are more surface gravity data available for this area than for any other portion of the circum-Pacific tectonic belt in addition to seismic refraction studies of the crust and the upper mantle. The surface gravity data consisted of free air anomaly maps, Bouguer anomaly maps, 1° × 1° free air and Bouguer gravity anomalies, bathymetric and elevation data, and 1° × 1° mean elevations and bathymetry. All data were compared with the satellite-determined gravity values. A general agreement was found to exist between the results of the frequency analysis and the geophysical analysis. K.W.

N69-18512# Royal Inst. of Tech., Stockholm (Sweden). Plasma Physics Div.
FUNDAMENTAL ELECTROMAGNETIC PROCESSES IN THE OUTER MAGNETOSPHERE
C.-G. Fälthammer Aug. 1968 20 p refs Presented at the IITR Advanced Study Inst. Aurora and Airglow, As, Norway, 27 Aug.-8 Sep. 1968
(Rept-68-14) Avail: CFSTI

In dealing with the complex magnetosphere system it is necessary to resort to idealized models having only some suitably chosen feature in common with the real system, and historical notes on such approaches are presented. The gyrocenter approximation in auroral theory allows one to follow the motion of single particles. Particle motion with feedback via the fields, forbidden regions and theories of the plasma pause are also considered. The magneto–hydrodynamic approach gives a relatively simple description of some facets of the particles' collective behavior. New magnetospheric processes involving plasma instabilities (anomalous conductivity, acceleration of particles) are discussed and show that plasma physics, particularly laboratory experiments, can narrow hypotheses about magnetospheric processes. ESRO

N69-18516 National Lending Library for Science and Technology, Boston Spa (England).
INVESTIGATIONS OF RISING AIR CURRENTS WITH GLIDERS
Ju. V. Cernov [1968] 12 p refs Transl. into ENGLISH from Cent. Aerol. Obs. (Moscow), no. 63, 1965 p 70–76
(NLL-M-7488-(5828.4F) Avail: Natl. Lending Library, Boston Spa, Engl.

Some information is presented on the use of flight methods for studying rising air currents. An analysis of the structure of rising air currents is given and some statistical relationships are presented which characterize the frequencies of rising and descending air currents over flights of one hour or routes of 100 km. Author

N69-18552 Florida Univ., Gainesville.
ATMOSPHERIC ATTENUATION OF ELECTROMAGNETIC RADIATION IN THE INFRARED SPECTRAL REGION
John Lemuel Streete (Ph.D. Thesis) 1967 127 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-9569

Measurements of atmospheric transmittance in the wavelength range 0.56 micron to 10.7 microns were made over a 24.9-km horizontal path at sea level. Absorption spectra were recorded in the Cape Kennedy area; the optical path was principally over water. The measured spectra were reduced point-by-point to give absolute transmittance values. From the replotted curves of transmittance versus wavelength, the selective transmittance of regions (called windows) relatively free from absorption bands was measured. Also, scattering coefficients were obtained from the transmittance data. The selective transmittance data were analyzed by means of theoretical and empirical equations relating transmittance to the amount of water vapor in the path. Solar spectra, obtained prior to this experiment, were also analyzed in this manner. It was found that the data were described equally well by either equation. A definite pressure-broadening effect was observed. Dissert. Abstr.

N69-18686*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

STATISTICAL ESTIMATION OF TROPOSPHERIC TEMPERATURES AND RELATIVE HUMIDITIES FROM REMOTE RADIOMETRIC MEASUREMENTS

Barney J. Conrath Jan. 1969 44 p refs

(NASA-TM-X-63460; X-622-69-14) Avail: CFSTI CSCL 04A

A formulation is given for making statistical estimations of tropospheric temperatures, relative humidities, and total water vapor content from remote spectral measurements of the infrared radiation emitted by the earth and atmosphere. Simultaneous measurements in the 6.3μ water vapor band, the atmospheric window near 11μ, and in the 15μ carbon dioxide band are required. The formulation can serve as a framework for analyzing the expected information content of measurements of the type to be obtained from forthcoming satellite experiments such as the infrared interferometer spectrometer (IRIS). Examples are given of applications to five ensembles of atmospheric soundings chosen to be representative rather than exhaustive. The fractions of the variance of temperature and relative humidity accounted for by the radiation measurements are found to vary considerably from one type of ensemble to another, and in all cases are strong functions of instrumental noise. Author

N69-18687*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ELECTRIC FIELDS IN THE VICINITY OF AURORAL FORMS FROM MOTIONS OF BARIUM VAPOR RELEASES

Eugene M. Wescott, John D. Stolarik, and James P. Heppner Feb. 1969 46 p refs

(NASA-TM-X-63466) Avail: CFSTI CSCL 04A

Barium vapor clouds were released during evening twilight between invariant magnetic latitudes of 67.3° to 68.1° from Andoya, Norway. Visual auroral displays were observed in the vicinity during all flights. In the negative bay situation, barium ion cloud motions were eastward, and closely parallel to auroral arc alignments. Electric fields transverse to the magnetic field with intensities of 10 to 130 mv/m directed southward were observed. During the positive bay event the barium clouds spanned the breakup transition region, with the two equatorwards clouds moving westward while the poleward cloud went east. Observed reversals in direction were closely correlated with magnetic variations. North directed electric fields of up to 50 mv/m were found in the positive bay sector. In all events the ion cloud motions revealed that E was perpendicular to the ionospheric current, hence we conclude that the auroral electrojets, both eastward and westward, are essentially Hall currents. Author

N69-18700*# National Meteorological Center, Suitland, Md. Upper Air Branch.

METEOROLOGICAL ROCKET RESEARCH SINCE 1959 AND CURRENT REQUIREMENTS FOR OBSERVATIONS AND ANALYSIS ABOVE 60 KILOMETERS

Roderick S. Quiroz Washington NASA Feb. 1969 69 p refs

(NASA Order L-719)

(NASA-CR-1293) Avail: CFSTI CSCL 04A

A detailed survey is made of routine rocket soundings since 1959, yielding measurements of neutral parameters up to 80 km, and of special rocket soundings giving data to ca. 100 km. The distribution of soundings, of which only 21% have been taken in latitudes north of 40°N, is given by station and year for more than 30 rocket sites, including foreign locations. Observational accuracies are examined in sufficient depth to permit an evaluation of the broad validity of the measurements. The observational errors may be appreciable, depending on the conditions of measurement, yet the observations are considered to efficiently delineate the broad atmospheric structure and circulation above radiosonde levels. Error contamination, however, may be critical in small-scale analysis. Author

N69-18703# Royal Aircraft Establishment, Farnborough (England).

AIR DENSITY AT A HEIGHT OF 470 KM BETWEEN JANUARY 1967 AND MAY 1968, FROM THE ORBIT OF THE SATELLITE 1966-118A

D. G. King-Hele and Doreen M. C. Walker Jul. 1968 33 p refs

(RAE-TR-68184) Avail: CFSTI

Values of air density at a height of 470 km are calculated by analyzing the orbit of the satellite 1966-118A, an Agena rocket. In all, 94 values of air density are obtained at average intervals of 5 1/2 days between January 1967 and the end of May 1968. The results confirm that there was a large semi-annual variation in air density during 1967, with the maxima (centred at April 5 and November 2) exceeding the July minimum (centred at July 31) by a factor of 2.2, and exceeding the January minimum (centred at January 18) by a factor of 2.2, after correction for the effects of solar activity. In the first half of 1968 the semi-annual variation was smaller, with the maxima in October 1967 and April 1968 exceeding the minimum in January-February 1968 by a factor of about 1.6. When these results are combined with previous data obtained by Jacchia and by Cook, it appears that the amplitude of the semi-annual variation undergoes an oscillation with a period of about 33 months, with maxima in early 1959, late 1961, early 1964 and (largest of all) early 1967, and minima in early 1960, late 1962 and at the end of 1965. These variations may be linked with the oscillations in zonal stratospheric winds, for which the pattern of dates has been similar since 1963. Author (ESRO)

N69-18707# Royal Aircraft Establishment, Farnborough (England).

EVALUATION OF ODD ZONAL HARMONICS IN THE GEOPOTENTIAL, OF DEGREE LESS THAN 33, FROM THE ANALYSIS OF 22 SATELLITE ORBITS

D. G. King-Hele, G. E. Cook, and Diane W. Scott Jul. 1968 53 p refs

(RAE-TR-68202) Avail: CFSTI

Coefficients of the odd zonal harmonics in the Earth's gravitational potential J_3, J_5, J_7, etc. are evaluated by analysing the variations in orbital eccentricity of 22 satellites, chosen to give the widest and most uniform possible distribution in semi major axis and inclination. These satellites provide 22 simultaneous equations for the coefficients J_3, J_5, etc., and the equations are solved by the least-squares method for sets of coefficients of successively higher order. The solutions show that J_9 may be taken as zero, and that, for $9 < n < 33$, the odd J_n do not differ

significantly from zero unless n is a multiple of 3. Consequently $J_{\frac{1}{3}}$, it is feasible to carry the solutions to harmonics of much higher degree than was previously possible. Author (ESRO)

N69-18782# Kiruna Geophysical Observatory (Sweden).
KIRUNA GEOPHYSICAL DATA, APRIL–JUNE 1967
G. Gustafsson, ed. and L. Liszka, ed. 1967 70 p *Its* Data Sum. 67/2
Avail: CFSTI

Geomagnetic indices, magnetic pulsations, three hourly earth current amplitude values, ionospheric absorption data, riometer recordings and normal magneto grams obtained at Kiruna Geophysical Observatory are given for April-June 1967. ESRO

N69-18792# Centro Nazionale di Fisica dell'Atmosfera e Meteorologia, Rome (Italy).
A THEORY OF COMBINATION COEFFICIENTS FOR IONS AND AEROSOLS [TEORIA DEI COEFFICIENTI DI COMBINAZIONE TRA PICCOLI IONI E PARTICELLE DI AEROSOL]
Giovanni Angelo Dalu Consiglio Nazl. delle Ric. Mar. 1968 13 p refs In ITALIAN
(CENFAM-SR-21) Avail: CFSTI

The interactions between ions and aerosols dispersed in the atmosphere are considered and combination coefficients are deduced dynamically without using the Boltzmann distributions. ESRO

N69-18807# International Centre for Theoretical Physics, Trieste (Italy).
INTERNAL GRAVITY MASS WITH VELOCITY GRADIENTS
Alden McLellan IV Jan. 1968 43 p refs Sponsored by NASA
(Grant NGR-28-001-016)
(IC-68-9) Avail: CFSTI

Low-frequency waves with small amplitudes are treated in a two-dimensional isothermal compressible fluid medium with a velocity gradient and within a constant gravitational field. A local dispersion relation governing the wave propagation for constant velocity gradients is derived from the linearized equations of fluid dynamics and thermodynamics. Linear and parabolic velocity gradients are treated by a generalized W.K.B. method. Equations are found which give the height at which wave reflection occurs. This determines the maximum heights up to which the wave modes can propagate. Dissipative effects arising from viscosity and heat conduction have been neglected. Author (ESRO)

N69-18828# Centro Nazionale di Fisica dell'Atmosfera e Meteorologia, Rome (Italy).
THE SCAVENGING OF ATMOSPHERIC PARTICLES BY ICE PHASE
Ottavio Vittori Antisari and Vittorio Prodi (CNEN, Bologna, Italy) Consiglio Nazl. delle Ric. May 1968 40 p refs Sponsored by CNEN Submitted for publication
(CENFAM-RDP-4) Avail: CFSTI

The capability of ice crystals growing in supercooled clouds of including foreign particles in their structure is examined in a Nakaya chamber. The results of a series of experiments concerning the wash-out ratios of condensing water and growing ice show that the efficiency of capture of atmospheric particles is higher, by a factor of 16, with ice than with water. The existence of the Facy 'dust free space' around evaporating surfaces is confirmed and is considered in connection with the Stefan flow as an important mechanism for bringing particles toward ice surfaces by the evaporation of supercooled droplets. This effect can account for the observed wash-out efficiency. Author (ESRO)

N69-18838# Royal Inst. of Tech., Stockholm (Sweden). Plasma Physics Div.
WHISTLERS-USE FOR DETERMINATION OF COMPOSITION AND TEMPERATURE
Stanley D. Shawhan Sep. 1968 32 p refs Presented at the ESRIN-ESLAB Symp. on Low Freq. Waves and Irregularities in the Ionosphere, Frascati, Italy, 23–27 Sep. 1968
(Rept.-68-17) Avail: CFSTI

A review is given of the theory of the 'Eckersley' whistler, the nose whistler, and the ion cyclotron whistlers. The technique for deriving the magnetospheric electron concentration from nose whistlers and the results concerning the 'knee' in the density profile and the plasmapause are discussed. From ion cyclotron whistlers the ion concentrations, the electron concentration, the ion gyrofrequencies, and the ion temperatures in the ionosphere can be obtained. The method is described and representative results are presented. The use of other whistler mode noise such as the lower hybrid resonance noise for the determination of composition and temperature is also discussed. ESRO

N69-18839*# Avco-Everett Research Lab., Everett, Mass.
TRIGGERING AN AURORA
L. M. Linson and H. E. Petschek Apr. 1968 47 p refs
(Contract NASw-1400)
(NASA-CR-100158; AERL-RR-287) Avail: CFSTI CSCL 04A

The suggestion is made that the creation of a significant enhancement of the ambient electron density at night in the lower ionosphere at auroral latitudes may trigger an aurora. The resulting increased drag affecting a sufficient number of magnetic flux tubes will disturb the natural convective flow in the equatorial plane of the magnetosphere around $L = 6$. Criteria which indicate the required size of the electron cloud ($\approx 10^3$ km^3), its density ($\approx 10^6$ electrons cm^{-3}), and its location (≈ 115 km altitude) are discussed. Such a large electron cloud is also useful for studies of the physics of the ionosphere. The necessary energy requirement and a preliminary evaluation of several methods which might be used to produce the desired ionization are discussed. Author

N69-18893 New York Univ., N. Y.
ON THE GROWTH OF THE SPECTRUM OF A WIND GENERATED SEA ACCORDING TO A MODIFIED MILES–PHILLIPS MECHANISM AND ITS APPLICATION TO WAVE FORECASTING
Tokujiro Inoue (Ph.D. Thesis) 1967 81 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-10070

It is necessary to develop detailed numerical forecasting techniques that accurately specify the process of wave generation because the need for accurate wave forecasts is increasing. The growth of the wave spectrum can be approximated by the combined effect of two mechanisms to a point where the crest of the wave breaks or a nonlinear effect becomes dominant. One mechanism is the Phillips resonance mechanism for wave generation, and the other is the exponential growth mechanism, originally proposed by Miles. Recently, this second growth mechanism was revised by Phillips in terms of the wave-induced atmospheric perturbations. Calculations suggest that this new mechanism explains the available observations, which had previously been unexplainable from the original instability growth mechanism. Dissert. Abstr.

N69-19010# Kiruna Geophysical Observatory (Sweden).
KIRUNA GEOPHYSICAL DATA, JANUARY-MARCH 1967
G. Gustafsson ed. and L. Liszka ed. 1967 71 p *Its* Data Sum. 67/1
Avail: CFSTI

Geomagnetic K-indices, magnetic pulsations, three hourly earth current amplitude values, ionospheric absorption data, riometer

recordings and normal magnetograms obtained at Kiruna Geophysical Observatory are given for January-March 1967.
ESRO

N69-19021*# Volt Information Sciences, Inc., Washington, D. C.
THEORETICAL SHAPE OF THE MAGNETOSPHERE BOUNDARY TAKING INTO ACCOUNT THE GEOMAGNETIC DIPOLE INCLINATION TO THE GEOGRAPHIC AXIS AND THE NON-DIPOLE PART OF THE GEOMAGNETIC FIELD
N. M. Rudneva Greenbelt Md. NASA. Goddard Space Flight Center 28 Feb. 1969 10 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 9, no. 1, 1969 p 23-28
(Contract NAS5-12487)
(NASA-CR-100027; ST-GM-PF-10812) Avail: CFSTI CSCL 04A

The boundary of the magnetosphere is computed taking into account the inclination of the geomagnetic dipole and the nondipole part of the geomagnetic field. The latter has little effect on the boundary of the magnetosphere. The asymmetry of the magnetosphere on the daytime side must result in the asymmetry of the tail.
Author

N69-19024*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
A TECHNIQUE TO INFER ATMOSPHERIC TEMPERATURE FROM HORIZON RADIANCE PROFILES
Thomas B. McKee, Ruth I. Whitman, and Jules J. Lambiotte, Jr. Washington Feb. 1969 33 p refs
(NASA-TN-D-5068) Avail: CFSTI CSCL 04A

A technique is presented to infer atmospheric temperature structure from horizon radiance profiles. The technique was implemented for a spectral region of absorption due to the CO_2 molecule (615 cm^{-1} to 715 cm^{-1}). Inferred temperature accuracy is shown when input data are errorless and when input data have been perturbed with errors for the altitude range from 20.5 km to 55.5 km. Atmospheric temperatures were inferred from measured horizon radiance profiles and compared with estimated temperature structure as an example of the application of the technique to real data.
Author

N69-19029*# GCA Technology Div., GCA Corp., Bedford, Mass.
ROCKET RELEASE OF TRIETHYL BORON Final Report
J. Pressman Sep. 1968 53 p refs
(Contract NASw-1419)
(NASA-CR-100026; GCA-TR-68-12-N) Avail: CFSTI CSCL 04A

This report describes an experiment in which two rockets, each carrying a compound payload consisting of a canister of triethyl boron (TEB) and a 5577Å photometer were used to probe the atomic oxygen region. The nighttime flight reported a profile of the 5577Å emission which had a sharper lower boundary, a more rapid decrease with height and thus a much smaller half-width than previous similar altitude profile measurements. The differences are so great that the new measurements require verification even though they more closely resemble the theoretically expected profile. No TEB chemiluminescence was observed. This is due either to a malfunction of the release mechanism or actual lack of chemiluminescence in contradiction with laboratory data. The twilight trail gave a fluorescence at least as bright as that of TMA. A new BO_2 band, not observed in previous twilight spectrum was recorded. The band is at 4072.2Å and assigned to the $X\ ^2\Pi_{e1/2}$-$B\ ^2\Sigma^+$, 000-000 transition unlike the other transitions assigned to the X-A states.
Author

N69-19108# National Meteorological Center, Suitland, Md.
NORTHERN HEMISPHERE CLOUD COVER FOR SELECTED LATE FALL SEASONS USING TIROS NEPHANALYSES
Philip F. Clapp Dec. 1968 25 p refs
(WBTM-NMC-44) Avail: CFSTI

Northern Hemisphere fields of mean cloudiness were constructed using TIROS nephanalyses for the late fall seasons (Oct. to Dec.) of 3 years, 1962 to 64. These may be useful in studies of cloud climatology and year-to-year variations of the earth-atmosphere heat budget; and for designing and testing cloud modeling procedures in munerical experiments. Shortcomings were revealed in the present subjective nephanalysis documentation which hopefully will soon be corrected by the promising work now going on in digitizing the video pictures.
Author

N69-19109# Weapons Research Establishment, Adelaide (Australia).
UPPER ATMOSPHERE RESEARCH BIBLIOGRAPHY OF CONTAMINANT RELEASE EXPERIMENTS
C. H. Low Oct. 1968 19 p refs
(HSA-178) Avail: CFSTI

Since 1960, observations of chemical seeding experiments in the upper atmosphere have been made by W.R.E. A bibliography of results obtained from these and other observations has been prepared. In order to increase the usefulness of the bibliography many papers on related work carried out elsewhere in the world are included. Papers are listed under four headings: (1) results of contaminant release experiments; this section includes papers on atmospheric structure, chemistry, ion releases and explosions; (2) spectral observations of aluminised explosive releases; (3) the diatomic AlO molecule; and (4) W.R.E. papers on contaminant release experiments.
Author

N69-19137*# Allied Research Associates, Inc., Concord, Mass.
NIMBUS EARTH RESOURCES OBSERVATIONS, PROJECT NERO
Romeo R. Sabatini and John E. Sissala [1968] 75 p refs
(Contract NAS5-10343)
(NASA-CR-100020; Rept-9G45-24; TR-7) Avail: CFSTI CSCL 08

A survey of non-meteorological investigations completed with Nimbus photographic and infrared data are reported. Only a minimal portion of the voluminous amounts of data have been analyzed for non-meteorological applications, and already the data have found applications in such fields as oceanography, geology, geography, and hydrology. The non-meteorological applications presented herein are definitively pertinent to the assessment of many proposed experiments for future Earth Resources satellites.
Author

N69-19179*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
SPATIAL VARIATIONS OF THE MAGNETOSHEATH MAGNETIC FIELD
Kenneth W. Behannon and Donald H. Fairfield Feb. 1969 34 p refs
(NASA-TM-X-63471; X-616-69-61) Avail: CFSTI CSCL 04A

Measurements by Explorers 28, 33, 34 and 35 have been used to study the spatial characteristics of the magnetic field in the magnetosheath to a distance of 70 R_E behind the earth. Results indicate that the magnetosheath field is several times the strength of the simultaneously measured interplanetary field in the sunward magnetosheath. This magnetosheath to interplanetary magnitude ratio decreases with distance from the subsolar point to values which are frequently less than unity at distances beyond 30 R_E and away from the bow shock. This ratio also displays a dawn-dusk asymmetry which is dependent on the interplanetary field orientation. Interplanetary field lines perpendicular to the earth-sun

line are associated with symmetrically distorted magnetosheath field lines in the dawn and dusk hemispheres and are consistent with the draping of field lines around the magnetosheath. When the interplanetary field is aligned near the spiral angle, fields measured in the dusk hemisphere are much more ordered than those measured in the dawn hemisphere behind the earth. Author

N69-19180*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOME WINTER CHARACTERISTICS OF THE NORTHERN HIGH LATITUDE IONOSPHERE
N. J. Miller and L. H. Brace Dec. 1968 27 p refs
(NASA-TM-X-63468; X-621-68-495) Avail: CFSTI CSCL 04A

Langmuir probe measurements of the winter diurnal behavior of the electron density (N_e) and temperature (T_e) at 1000 km at high latitudes are presented. The data are represented by contour plots of N_e and T_e on a grid of geomagnetic latitude and local time. The N_e distribution is characterized by a zonal structure where the auroral oval is the transition region between the midlatitude and polar zones. N_e in the midlatitude zone exhibits a quasi-steady state through most of the night and both N_e and T_e increase in value to an afternoon maximum. N_e in the dark polar zone decays until midnight after which the ionization increases toward a daytime level. The transition region, represented by the oval, shows enhancements in N_e suggestive of particle flux sources. In general, the dayside T_e contours do not correlate with the N_e contours. Limited comparisons between winter and summer indicate strong seasonal effects in the N_e pattern unusually large values of T_e in the winter midlatitude zone. Characteristic troughs in N_e appear on the nightside for both seasons. Possible ionization sources which would be consistent with the observed ionization patterns are considered. Author

N69-19187*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN IMPROVED MODEL EQUATORIAL ELECTROJET WITH A MERIDIONAL CURRENT SYSTEM
M. Sugiura and D. J. Poros (Vitro Serv.) Feb. 1969 28 p refs Presented at the 3d Intern. Symp. on Equatorial Aeronomy, Ahmedabad, India, 3–9 Feb. 1969
(NASA-TM-X-63473; X-612-69-74) Avail: CFSTI CSCL 08N

The model for the equatorial electrojet presented earlier is revised by including a meridional current system, thus making the current density divergence-free. Using a spherical harmonic expansion for the geomagnetic field a model electrojet is constructed for each of the longitudes of 0°, 40°, 80°, 180°, and 280°E. It is shown that the essential feature of the meridional current system is the existence of two current loops, one on each side of the dip equator and with an equatorward current in the lower E region, an upward current over the dip equator, and a return current flowing in the upper E region. The intensities of the electrojet and the associated meriodional current are significantly dependent on longitude, being strongest over Peru and weakest over India. The new model predicts a reversed (westward) current in a thin, narrow layer located at several degrees off the dip equator, which is due to a reversal of the vertical polarization field. The meridional current loop creates a toroidal magnetic field of an intensity comparable with that of the main electrojet. Author

N69-19192# Universidad Mayor de San Andres, La Paz (Bolivia). Laboratorio de Fisica Cosmica.
IONOSPHERE DATA, JULY 1967–MARCH 1968 [DATOS IONOSFERICOS, JULIO 1967–MARZO 1968]
C. R. Mejia and A. Lazo Paz Mar. 1968 66 p In SPANISH Supported in part by ESSA
Avail: CFSTI

Tabulated data on the characteristics of the ionosphere are presented. This includes hourly values for the F_1, F_2, and E regions. Transl. by F.D.S.

N69-19253# Weapons Research Establishment, Salisbury (Australia).
IONOSPHERIC DATA FOR MARCH 1968 FROM SALISBURY, SOUTH AUSTRALIA
May 1968 27 p *Its* Ionospheric Data Bull. CPD-1968/3(S)
Avail: CFSTI

Tables of the hourly values of the customary ionospheric parameters are given for the station at Salisbury for March 1968. Author

N69-19266*# Michigan Univ., Ann Arbor. High Altitude Engineering Lab.
ANALYSIS OF MICROWAVE OCCULTATION TECHNIQUES FOR ATMOSPHERIC SOUNDINGS
M. E. Graves and F. F. Fischbach Jan. 1969 62 p refs
(Contract NASr-54(03))
(NASA-CR-100253; REPT-05863-16-T) Avail: CFSTI CSCL 04A

Multi-satellite schemes to sound the Earth's atmosphere are reviewed from the standpoint of data handling, and some important problems are discussed, such as: (1) Abelian inversion of a limited number of phase measurements; (2) Exclusion of water vapor refraction; (3) Aspherical stratification effects of water vapor. Data analysis techniques for the Mars microwave occultation experiment of 1965 are examined, with special attention given to inversions of phase delay and their potential in Earth-atmosphere investigations. Difficulties inherent in techniques which do not perform an analytic data inversion along the refracted ray are considered. Numerical estimates are made of water vapor effects upon tangent ray height and spherical stratification of refractivity. A dispersion method for retrieving air density is presented and its errors are summarized qualitatively. The differential refraction is tabulated for a satellite pair, one synchronous. Author

N69-19308# Radio and Space Research Station, Slough (England).
A REVIEW OF THE LARGE-SCALE STRUCTURE OF THE IONOSPHERIC F-LAYER
J. W. King 1968 62 p refs
Avail: CFSTI

The major features of the ionospheric F-layer between 200 and 2000 km in the equatorial, mid-latitude and high-latitude regions are reviewed. The topics covered include: the equatorial anomaly and sub-peak stratification at low latitudes; the global morphology and major anomalies, including the midnight maxima, at middle latitudes; the effects of neutral air winds, photoelectrons (at sunrise) and energetic particles on the F-layer; Universal Time effects; the relationship between the high-latitude ionization troughs and the plasmapause; and the form of the electron concentration distribution above the layer peak. Author

N69-19332 National Lending Library for Science and Technology, Boston Spa (England).
INTERCONNECTIONS OF ZONAL AND MERIDIONAL CIRCULATION AND THEIR ANOMALIES IN THE NORTHERN AND SOUTHERN HEMISPHERES
G. M. Tauber [1968] 30 p refs Transl. into ENGLISH from Gidromet. Nauc.-Issled. Cent. SSSR (Leningrad), v. 5, 1967 p 78–103
(NLL-M-7472-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

Physical and statistical relationships are deduced between the main circulation types and their intensity anomalies in the

northern and southern hemispheres on the basis of the mean monthly zonal and meridional circulation indices for the middle months of winter and summer (January and July). Distinguishing features of the circulations of the two hemispheres over both land and sea are also discussed. Author

N69-19337 National Lending Library for Science and Technology, Boston Spa (England).
THREE-DIMENSIONAL OBJECTIVE ANALYSIS OF THE GEOPOTENTIAL FIELD
M. S. Tatarskaja [1968] 21 p refs Transl. into ENGLISH from Gidromet. Nauch. Issled. Cent. SSSR (Leningrad), no. 1, 1967 p 125–133 In ENGLISH and RUSSIAN
(NLL-M-7484-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl. CSCL 08N

A scheme is considered for the objective analysis of the geopotential field which makes use of additional data from other levels. Author

N69-19338 National Lending Library for Science and Technology, Boston Spa (England).
ON THE EVOLUTION OF THE POLAR STRATOSPHERIC CYCLONE AND THE INTERRELATIONSHIP BETWEEN PROCESSES IN TROPOSPHERE AND STRATOSPHERE
I. G. Pchelko [1968] 14 p refs Transl. into ENGLISH from Gl. Upr. Gidromet. Sluzhb. Met. Gidr. (Leningrad), no. 12, 1967 p 21–32
(NLL-M-7466-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

The problem discussed is to find in what specific forms various special features in the evolution of the winter stratospheric cyclone are manifested and to what extent these special features characterize the interaction between processes in troposphere and stratosphere. Four forms of pressure relief are established in the stratosphere, each determining different special features in the evolution of the stratospheric cyclone. The use of circulation indices and the drawing of paths of centers of cyclones and anticyclones for a number of cases showed that for each of stratospheric cyclonic circulation there corresponds a definite direction of development of synoptic processes in the troposphere. Author

N69-19339 National Lending Library for Science and Technology, Boston Spa (England).
THE MAIN REGULARITIES IN THE DISTRIBUTION OF GLAZED FROST PHENOMENA IN THE NORTH-WESTERN REGIONS OF THE EUROPEAN USSR
E. P. Dranevich 1968 14 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Obser. (Leningrad), no. 232, 1968 p 3–12
(NLL-M-7464-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

Instrumental glazed frost observations were made at 37 meteorological stations distributed uniformly over the Leningrad, Pskov, and Novgorod regions. The initial meteorological data were for the ten year period 1953 to 1963. The temperature and wind speed and direction for the beginning of glazed frost were taken from TM-1 and TM-5 monthly tables; those for the end of the phenomenon from additional observations in KM-2 record books, from which information was also extracted on weather phenomena accompanying glazed frost, air humidity, and the form and height of clouds. Weather bureau synoptic and aerological charts and pilot balloon and radiosonde observations were used in the analysis. Author

N69-19340# Woods Hole Oceanographic Institution, Mass.
TURBULENCE AND TURBULENT FLUXES OVER THE PACIFIC OCEAN IN THE LINE ISLANDS REGION
Andrew F. Bunker Jan. 1969 32 p refs /its Reference No. 69-2
(Grants NSF GA-821; NSF GA-1490)
Avail: Issuing Activity

Measurements of the vertical and longitudinal components of the turbulent wind, fluctuations of the temperature and humidity, and turbulent transports of heat and water vapor were made from an aircraft flying over the Pacific Ocean in the Line Islands and Canton Island region during April and May 1967. Observations were made from 50 to 3720 meters above the sea in both clear air and in cumulus clouds and rain. The results of 149 one-minute runs are tabulated and discussed. Charts and vertical graphs are presented to show the variation of the turbulence parameters with height, region, and cloud condition. The direction of the sensible heat flux is discussed in terms of the different zones and weather conditions. Author

N69-19393 National Lending Library for Science and Technology, Boston Spa (England).
ON THE PROBLEM OF THE MECHANISM OF THE FORMATION OF ICE CRYSTALS IN THE ATMOSPHERE
N. V. Gliki [1968] 10 p refs Transl. into ENGLISH from Nauc. Sov. Fiz. Tver. Tela, Sect. "Obrazov. Kristall.", Otdel Fiz. Tver. Tela Poluprovod. Akad. Nauk BSSR (USSR), p 74–78
(NLL-M-7494-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

A cycle of experimental studies was carried out to determine the characteristics of droplet crystallization of a supercooled liquid, to define the forms of the subsequent sublimation growth of the solid granules, and to explain the mechanism of the conversion of cloud droplets into discrete prismatic or laminar crystalline particles or snow flakes. The experiments were conducted with water droplets of a diameter of some hundreds of microns ('coarse') or some tens of microns or less ('fine'). A jet was used to suspend the droplet on a fine glass thread and to insert it into a chamber previously evacuated at a given temperature. To cause the supercooled droplets to freeze, particles of appropriate ice-forming bodies were generally introduced. By studying the freezing of coarse droplets, it was established that a series of crystallization foci usually formed on the droplet surface, and a denticulate crystallization front quickly traveled in the direction of their center. Polarized light showed that the solid phase propagated in straight streaks inside the droplet, which froze in the form of a semi-crystallized aggregate. K.W.

N69-19421# Oulu Univ. (Finland). Dept. of Electrical Engineering.
MOVEMENT IN THE SCINTILLATION FRONTIER IN THE POLAR IONOSPHERE [BEWEGUNGEN DER SZINTILLATIONSGRENZE IN DER POLAREN IONOSPHAERE]
A. Taurisainen 1968 11 p refs In GERMAN; ENGLISH summary (S-2) Avail: CFSTI

The occurrence of scintillation observed in the Faraday rotation in Sodankylä and in Oulu is studied. Special attention is paid to the sudden beginning of the scintillation. The observations show that the frontier of the scintillation in the polar ionosphere moves to the south before midnight and back to the north some hours later. This movement seems to have connection with similar movements of the trough in the electron content observed during the night in the auroral zone. Author

N69-19425 National Lending Library for Science and Technology, Boston Spa (England).
ON THE MECHANISM BY WHICH SOLAR ACTIVITY AFFECTS THE CYCLE OF OSCILLATIONS IN THE ATMOSPHERIC CIRCULATION
B. B. Elekov 26 Nov. 1968 12 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), no. 8, 1968 p 703–707
(NLL-M-566-(8022.551)) Avail: Natl. Lending Library, Boston Spa, Engl.

The mechanism of the origin of unstable perturbations on a planetary scale in the zonal baraclinic current under the action of lunar and solar semi-diurnal tides is studied. A system of action is suggested for solar activity on the length of the change from a zonal type of circulation to meridional. Author

N69-19426*# National Aeronautics and Space Administration, Washington, D. C.
DISPERSION AND ABSORPTION OF SOUND IN CLOUDS [DIE DISPERSION UND ABSORPTION DES SCHALLES IN WOLKEN]
Kl. Oswatitsch May 1967 23 p refs Transl. into ENGLISH from Physik. Z. (West Ger.), v. 42, no. 21/22, 1941 p 365–378 (NASA-TT-F-10939) Avail: CFSTI CSCL 04A

The dispersion and absorption of sound in clouds of high water content and in ice clouds, due to condensation or evaporation of droplets suspended in the air, is discussed from a mathematical viewpoint. Dispersion and absorption formulas are derived for two extreme cases, one of low frequency in which the condensation rate of the droplets is sufficient for maintaining the saturation state, and one of high frequency, in which the amount of vapor absorbed or given off by the droplets in the available time is too small for producing a noticeable deviation from the dry-adiabatic change of state. The changes in velocity of sound and in absorption are plotted for various frequencies as a function of temperature, pressure, and angular velocity. Author

N69-19468# National Academy of Sciences-National Research Council, Washington, D. C. Space Science Board.
PHYSICS OF THE EARTH IN SPACE. A PROGRAM OF RESEARCH: 1968–1975
Oct. 1968 113 p
Avail: CFSTI

The scientific objectives toward which research on the physics of the Earth's environment should be directed in the period through 1975 are examined, and the required technologies as well as research coordination for attaining these objectives are discussed. The Sun-Earth system is treated as a set of strongly interacting components, with the Sun as the energy source driving the system. Present knowledge of near-Earth physics is compared with that of ten years ago, when space research with artificial satellites began. With present knowledge as the basis, a program is defined for exploring the fundamental physical mechanisms of the Sun-Earth system by means of satellites, space probes, and sounding rockets. The study is arranged by topics as follows: the Sun as energy source; the interplanetary medium; the magnetosphere; the ionosphere; the neutral atmosphere; and related topics. K.W.

N69-19483# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.
FIELD-ALIGNED CURRENTS AND AURORAL PRECIPITATION
L. P. Block and C. G. Faelthammar Jul. 1968 15 p refs (Rept-68-12) Avail: CFSTI

Auroral current system containing field-aligned currents flowing between the magnetosphere and the ionosphere are studied. Effects that such currents can have on the ionosphere and their relation with the precipitation of auroral primary particles are presented. A quantitative analysis of the height-distribution of ionospheric density in the presence of field-aligned currents (and plasma convection) has recently been made. It was found that current densities of the order of 10^{-6}amps/m^2 may cause considerable changes in the equilibrium distribution of ionization, including large density reductions in the topside. For a given current density the effect on the ionosphere depends on the ratio of ion current to electron current at the magnetospheric part of the flux tube. An outline of the theoretical model used and the results obtained is given. The results are most directly applicable to ionospheric density anomalies but field-aligned currents may also play a role for auroral precipitation.

N69-19504# Joint Publications Research Service, Washington, D. C.
OCEANOGRAPHY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space No. 197 30 Jan. 1969 p 21–31 refs (See N69-19501 08-34)
Avail: CFSTI

Climate, hydrological characteristics, and hydrochemistry of tropical oceans and the Atlantic Ocean are discussed in a number of studies. Attached abstracts contain scientific articles on hydrometeorological oceanographic processes and their effects on coastal zones and ocean bottom shapes. G.G.

N69-19505# Joint Publications Research Service, Washington, D. C.
TERRESTRIAL GEOPHYSICS
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space No. 197 30 Jan. 1969 p 32–44 refs (See N69-19501 08-34)
Avail: CFSTI

Seismic sounding methods, mathematical methods of hydrogeology, and magnetometric measurements on earth gravity and anomalous geomagnetic field pulsations are reported. G.G.

N69-19510 National Lending Library for Science and Technology, Boston Spa (England).
ON THE (ELECTRICAL) CHARGING OF CLOUD DROPLETS AND FOG DROPLETS BY DIFFUSION
N. S. Shishkin [1968] 8 p Transl. into ENGLISH from Akad. Nauk. Dokl. (Moscow), no. 176, 1967 p 1288–1291 In ENGLISH and RUSSIAN
(NLL-M-7489-(5828.4F) Avail: Natl. Lending Library, Boston Spa, Engl.

Formula are derived for determining the equilibrium charge of cloud and fog droplets in an attempt to account for dissimilarities in mathematical calculations and actual experimental results. Previous formulae were obtained which indicated that the equilibrium charge on such droplets in zero under specified conditions of current and air conductivity, but experimental data showed that water droplets are predominantly negatively charged. The formula derived herein are related to the action of a binary electrical layer and yield values of equilibrium charge in good agreement with measured results. A.C.R.

N69-19522# Comision Nacional de Estudios Geofisicos, La Paz (Bolivia).
REPORT ON GEODESY AND GEOPHYSICS, EXECUTED IN THE PERIOD 1963–1967
[1968] 37 p refs Presented at 14th Gen. Assembly of the Intern. Union of Geodesy and Geophys., Zurich, 1967
Avail: CFSTI

Work performed in Bolivia in the fields of geodesy, geomagnetism, cosmic rays, ionosphere, aeronomy, radioactivity, gravity, and seismology is reviewed. The triangulation network established consists fo 439 first order and 210 second and third order stations. A leveling net was concluded for the main road system. Seismic and magnetic data were collected from established sites and some of the values are tabulated. Extensive air shower studies are being conducted. B.P.

N69-19529# Joint Publication Research Service, Washington, D. C.
OCEANOGRAPHY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space No. 198 13 Feb. 1969 p 23–33 refs (See N69-19526 08-34)
Avail: CFSTI

Scientific conferences on sea ice and marine chemistry are briefly described and some work on seiche phenomena in arctic navigation is outlined. Attached abstracts of scientific papers

discuss marine biological problems, ocean currents, geological structures of ocean bottoms and coasts, as well as ice distribution forecasts. G.G.

N69-19530# Joint Publication Research Service, Washington, D. C.
TERRESTRIAL GEOPHYSICS
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space No. 198 13 Feb. 1969 p 34–43 refs (See N69-19526 08-13)
Avail: CFSTI

The modification of a long period vertical pendulum seismograph is described which increases its stability by eliminating the dependence of the natural period of the pendulum on its equilibrium position by utilizing a magnetic stabilizer. Attached brief abstracts contain earth structure analyses, magnetic field models, computations of seismic waves, and earthquake prediction methods. G.G.

N69-19587 National Lending Library for Science and Technology, Boston Spa (England).
A COMPARISON OF THE MAIN REGULARITIES IN THE CIRCULATION OF THE ATMOSPHERE OVER THE SOUTHERN AND NORTHERN HEMISPHERES
B. L. Dzerdzeevskij [1968] 15 p refs In ENGLISH and RUSSIAN Transl. into ENGLISH from Inform. Byull. Sov. Antarkt. Ekaped. (Leningrad), no. 65, 1967 p 58–68
(NLL-M-7492-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

The literature on variations and regularities in atmospheric circulation over the Northern and Southern Hemispheres was briefly surveyed. A comparative analysis of the published results was made to aid in understanding atmospheric processes and in long range weather forecasting. An attempt was made to establish similarities in the patterns of circulation over the two hemispheres. B.P.

N69-19600 National Lending Library for Science and Technology, Boston Spa, (England).
THE MYSTERY OF SIBERIAN DARKNESS
Ju. M. Emel'janov 1968 12 p refs Transl. into ENGLISH from Akad. Nauk. Priroda (Moscow), no. 6, 1968 p 87–91
(NLL-M-7497-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

An unusual eclipse which occurred in the Siberian area of the U.S.S.R. in 1938, lasting several hours, and in many cases causing total darkness is discussed; and a review of various conjectures as to its cause is included. A study was made of the regions which were affected, as well as reports of inhabitants who were present at the time. The author concluded that the probable origin of the dark cloud was in outer space and that it was formed from a dense mass of cosmic dust, falling during a brief time span and held in the upper layers of the atmosphere. It is emphasized that further study of this phenomenon is warranted due to recent interest on the study of cosmic dust and the need to determine methods of distinguishing this dust from that of terrestrial origin. A.C.R.

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N69-18304*# Arizona Univ., Tucson.
AN AUTOMATIC POLARIMETER FOR SPACE APPLICATIONS
S. F. Pellicori and P. R. Gray *In its* Commun. of the Lunar and Planetary Lab., Commun. Nos. 105–111, Vol. 7, Pt. 1 1967 p 25–31 refs Repr. from Appl. Opt., V. 6, Jun. 1967 p 1121 *Its* Commun. No. 107 (See N69-18301 08-30)
(Contract NASr-138)
Avail: CFSTI CSCL 20F

A compact automatic polarimeter was developed as a pilot model for lunar and planetary missions by spacecraft. The polarimeter simultaneously analyzes linearly polarized light into four intensities from which the Stokes parameters I, Q, and U can be determined. The measurements are made automatically by an electronic observation sequencer and an automatic gain selector. Five wavelength bands between 1900 Å and 6000 Å can used, and each measurement is calibrated automatically. The successful operation during three high altitude balloon flights indicates that the design is sound, and that with modifications for rocket vibration it can be used in space missions. The feature of making simultaneous measurements makes it particularly useful on planetary scans with fly-by probes. Preliminary results on the wavelength dependence of the polarization of the whole lunar disk, obtained ground-based, between 2850 Å and 5100 Å are presented. Author

N69-18306*# Arizona Univ., Tucson.
THE POLARISCOPE BALLOON-BORNE SERVO SYSTEM
Jack E. Frecker *In its* Commun. of the Lunar and Planetary Lab., Commun. Nos. 105–111, Vol. 7, Pt. 1 1967 p 39–44 refs *Its* Commun. No. 109 Supported in part by NASA and NSF (See N69-18301 08-30)
Avail: CFSTI CSCL 20F

The stable platform for the Polariscope 71 cm Cassegrain telescope that is mounted in a box-like aluminum gondola is described. It is designed to "lock on" certain stars or planets during balloon flights at 36 km altitude and to measure the polarization at 2250 and 2850 Å. Author

N69-18307*# Arizona Univ., Tucson.
A MECHANICAL COORDINATE CONVERTER
G. Van Biesbroeck and T. Gehrels *In its* Commun. of the Lunar and Planetary Lab., Commun. Nos. 105–111, Vol. 7, Pt. 1 1967 p 45–46 *Its* Commun. No. 110 (See N69-18301 08-30)
Avail: CFSTI CSCL 17

A simple device is described for mechanically converting spherical coordinates from one system to another for use in polariscope balloon programs. Author

N69-18308*# Arizona Univ., Tucson.
THE DESIGN OF LOW-COST PHOTOMETRIC TELESCOPES
Harold L. Johnson *In its* Commun. of the Lunar and Planetary Lab., Commun. Nos. 105–111, Vol. 7, Pt. 1 1967 p 47–55 ref *Its* Commun. No. 111 (See N69-18301 08-30)
Avail: CFSTI CSCL 17H

The design and construction of a low cost astronomical telescope intended specifically for photometric application is described, in which the final instrument represents a compromise between cost and precision. Rapid slewing requirements, implying the need for hand slewing, and cost restrictions on the type of polar bearings to be used reduced the choice to an instrument of the English yoke type, where the overall length of the tube is short and the specifications on setting, guiding and side-real tracking motions are at least as precise, as general purpose telescopes. Other specifications are being examined in order to keep the cost to a minimum, including the type of building in which the instrument is installed. The design of a 28 in. photometric telescope already in operation was applied to the construction of a 60 in. instrument, the resulting operation of which is briefly described. A.C.R.

N69-18509 Pennsylvania State Univ., University Park.
THE APPLICATION OF A BACKGROUND-LIMITED COPPER-DOPED GERMANIUM DETECTOR TO HIGH-RESOLUTION INFRARED SPECTROSCOPY
Soemitro Atmosoekarto (Ph.D. Thesis) 1967 70 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 68-11966

An unevacuated, high-resolution infrared echelle spectrometer of 2.5 m focal length, equipped with a background-limited copper-doped germanium detector, has been constructed. The performance of the spectrometer has been tested by looking at the HCN ν_2 Q-branch. The single-pass spectral resolution at 14 microns was at least 0.046 cm^{-1} and that of the double-pass was at least 0.02 cm^{-1}. It was necessary to use filters at low temperature to limit the field-of-view and to reduce background radiation in order to achieve the maximum detection. The choice of slit-length and detector size for an optimum signal-to-noise ratio is discussed. Dissert. Abstr.

N69-18523# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INTERPRETATION OF AERIAL PHOTOGRAPHS IN THEORY AND PRACTICE (SELECTED ARTICLES)
29 Mar. 1968 50 p refs Transl. into ENGLISH from Teoriya i Prakt. Deshifrirovaniya Aerosnimkov (Moscow), 1966 p 16–27, 55–60, 170–179
(AD-679721; FTD-HT-23-121-68) Avail: CFSTI

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2. SPECTROMETRIC AERIAL PHOTOGRAPHY USING A COMPUTER V. V. Kol'tsov p 20–28 refs (See N69-18525 08-14)

3. LANDSCAPE METHOD OF INTERPRETING AERIAL PHOTOGRAPHS OF THE BOTTOM OF SHALLOW SEA WATER K. M. Petrov p 29–43 refs (See N69-18526 08-14)

N69-18524# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ESTIMATION OF THE SPECTRAL BRIGHTNESS OF HAZE AND ITS EFFECT ON THE PHOTO INTERPRETATION OF AERIAL PHOTOGRAPHS
V. M. Bakhvalov *In its* Interpretation of Aerial Phot. in Theory and Pract. 29 Mar. 1968 p 1–19 refs (See N69-18523 08-14)
Avail: CFSTI

During aerial photography exposures through haze, the brightness of haze combines with the brightness of terrestrial objects and thus distorts their spectral brightness. Consequently, the author determines in a wide spectral range the curves of spectral brightness of the skies which with insignificant corrections may be interpreted as curves of the spectral brightness of haze as photographed from high altitudes. The overall brightness of the haze may vary within wide limits. Its spectral brightness, however, changes only in its short-wave region which is usually excluded during high-attitude photography. The spectral brightness of haze in the near infrared region is quite constant. The shape of the general atmospheric light scattering characteristics depends on the wavelength, and this must be taken into account during measurements as well as during the introduction of corrections into the brightness of the skies. Author

N69-18525# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SPECTROMETRIC AERIAL PHOTOGRAPHY USING A COMPUTER
V. V. Kol'tsov *In its* Interpretation of Aerial Phot. in Theory and Pract. 29 Mar. 1968 p 20–28 refs (See N69-18523 08-14)
Avail: CFSTI

The standard aerial photograph is unable to register various optical properties of natural objects which are often decisive for their identification. This situation may be improved to a significant degree by the application of photoelectric methods. The paper describes a new device in which the control of the brightness of the electron beam tube spot is carried out by signals proportional to the ratio of the spectral brightness of the objects for two chosen regions of the spectrum. The basic shortcoming of the device is its comparatively poor image sharpness. Author

N69-18526# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LANDSCAPE METHOD OF INTERPRETING AERIAL PHOTOGRAPHS OF THE BOTTOM OF SHALLOW SEA WATER
K. M. Petrov *In its* Interpretation of Aerial Phot. in Theory and Pract. 29 Mar. 1968 p 29–43 refs (See N69-18523 08-14)
Avail: CFSTI

The author surveys the so-called landscape method of aerial photograph interpretation as it applies to shallow water bottom photographs. The method is based on the fact that an aerial photograph reflects in an objective manner the landscape, its morphologic units, and its components. The paper discusses in considerable detail the landscape correlational interpretation signs, the location of such signs, the aerial photography standards, and the extrapolation of interpretation signs. The basic foundations of the shallow water bottom interpretation methods are discussed. Author

N69-18543*# Perkin-Elmer Corp., Norwalk, Conn. Optical Group.
FRAUNHOFER LINE DISCRIMINATOR Final Report
15 Apr. 1968 88 p refs
(Contract NAS9-7447)
(NASA-CR-99515; Rept-9148) Avail: CFSTI CSCL 20F

This airborne instrument system employs a new optical sensing technique whereby the intensity ratio between the continuum and the center of the Fraunhofer lines is reduced by the presence of fluorescent material. The system is capable of coping with the wide spectral differences of natural terrain as well as the vibration environment of the aircraft by making use of several novel developments, among them a narrow band filter located on the center of the 0.7-Å-wide Fraunhofer sodium line at 5890 Å. Compact optical design permits continuous sampling of the solar spectrum without a tracker or limitations on the direction of the aircraft. Effects of photomultiplier or preamplifier gain changes on the output signal are eliminated in the design. A real time analog computer is used for the data processing. Information on testing, calibration, operation, maintenance, storage, and other application possibilities is presented. K.R.

N69-18584 Arkansas Univ., Fayetteville.
CONTRIBUTIONS OF SYSTEM PARAMETERS IN THE DOPPLER METHOD OF FLUID VELOCITY DETERMINATION
Robert Levi Bond (Ph.D. Thesis) 1968 135 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 9620

The optical frequency Doppler heterodyne system made possible by the invention of the continuous wave laser was applied to the study of parameters which exist in flowing systems. The purpose of this study was to gain a thorough understanding of the

parameters involved. Among these were the factors contributing to the shape of the frequency spread distribution as presented on a spectrum analyzer, and to optimize the system based upon the knowledge gained. It was found that a heterodyne system using two backscattered beams symmetrically positioned on either side of the incident beam eliminated many problems which exist in systems in which the incident beam is heterodyned with a single scattered beam. The inherent variations in relative beam intensities were eliminated since both beams have the same secondary radiator as a source. The Doppler frequency spread caused by finite aperature diameter was cancelled out in the symmetrical system as was the spread caused by incident beam convergence angle. Other causes of Doppler frequency spread were determined. Dissert. Abstr.

N69-18679 Rochester Univ., N. Y.
DETECTION OF COSMIC GAMMA RAYS USING A SPARK CHAMBER COUNTER SYSTEM
Joseph Vernon Stewart (Ph.D. Thesis) 1968 142 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-9396

This thesis describes a spark chamber counter system designed to detect cosmic gamma rays. The results of a Monte Carlo calculation used to determine the response of the detector to incident gamma rays is compared with the experimental results. It is found that if one assumes that the single particle events are due to gamma ray interactions in the detector then the gamma ray spectrum at low energies must be steeper than that reported in the literature. Upper limits to the flux of 1 BeV gamma rays from several sources are determined. Dissert. Abstr.

N69-18698*# Perkin-Elmer Corp., Norwalk, Conn. Optical Group.
AIRBORNE FRAUNHOFER LINE DISCRIMINATOR, DESIGN REVIEW REPORT
15 Sep. 1967 70 p refs
(Contract NAS9-7447)
(NASA-CR-99514; Rept-8916) Avail: CFSTI CSCL 20F

The design review includes descriptions of the opto-mechanical design, electrical design, critical design parameters, installation of the system in the aircraft, expected performance, and some theoretical calculations. In-process testing, component tests, acceptance tests, and allowed tolerances of components are identified, including requirements critical to the performance. Error analyses are discussed for the optical, the electronic, and the computational channels. A list of purchased parts is included. K.W.

N69-18711# Commissariat à l'Energie Atomique, Bruyeres-le-Chatel (France). Service Radiochimie.
ALPHA SPECTROMETRY. GRID IONIZATION, AND IMPROVEMENT OF THE CHARACTERISTICS [SPECTROMETRIE ALPHA. CHAMBRE D'IONIZATION A GRILLE. AMELIORATION DES CARACTERISTIQUES]
René le Du and Bernard Miltenberger Sep. 1968 23 p refs
In FRENCH; ENGLISH summary
(CEA-R-3566) Avail: CFSTI

The signal rise-time of a grid ionization chamber depends on the orientation in the chamber and on the mobility of the ionization components. The CEA grid chambers and related circuits analyze the signals due to the electronic ionization components collected on the plate and on the source holder. Coincidences between these signals allow one to select paths of given orientations. An electronic collimator for α spectra studies, has now been built which does not have the disadvantages of a mechanical one and also reduces the background noise. Separation of the back-diffusion and the self-absorption phenomena of α source activity has also been achieved. Author (ESRO)

N69-18726# Aktiebolaget Atomenergi, Stockholm (Sweden).
CALIBRATION EXPERIMENTS WITH A DISA HOT-WIRE ANEMOMETER
Bjorn Kjellström and Stellan Hedberg Nov. 1968 123 p refs
(AE-338) Avail: CFSTI

From Collis' law and the direction sensitivity relation proposed by Hinze it is possible to derive the following relation between the voltage over the wire, the velocity and the angle of incidence of the flow: $V^2 - V_0^2/R(R-R_a) = b(\rho u)^n(\sin^2\Psi + k^2\cos^2\Psi)^{c/2}$. The values of the exponent c and the direction sensitivity coefficient k^2 were determined experimentally in the range $20 < \rho u < 180$ kg/sm^2. It was found that, if V_0 is the voltage measured with no net flow past the wire, c and k^2 are decreasing with increasing values of ρu. In order to check these calibration experiments, shear stress and turbulence measurements were made in a circular channel. For this geometry the shear stress distribution can be estimated theoretically and several earlier experiments can be used for comparisons. These experiments were made at Reynolds numbers $3 \cdot 10^5$-10^6, Mach numbers 0.1-0.3 and a channel length of 81 diameters. Excellent agreement with the theoretical shear stress distribution (corrected for compressibility effects) and earlier data for the axial and radial turbulence components was obtained when the results of the calibration experiments were used for the evaluation of these measurements. Evaluation with a constant value of c or with k^2 equal to zero (as often recommended) gave less good agreement. Author (ESRO)

N69-18728# Aktiebolagetatomenergi, Studsvik (Sweden).
SILICON DIODE DOSIMETER FOR FAST NEUTRONS
L. Svansson, P. Swedberg (Stockholm Inst. of Semicond. Res.), C.-O. Widell, and M. Wik (Swed. Inst. for Natl. Defence) Nov. 1968 41 p refs
(AE-339) Avail: CFSTI

The change of the current-voltage characteristics of a small silicon diode is used as a measure of fast neutron dose in the Fast Neutron Dosimeter 5422. This change is permanent and therefore it is possible to integrate doses over a long period of time. Doses from some rad up to 1000 rad can be measured and the information stored is not destroyed during readout. Considerable research work in this field has previously been carried out by the Swedish Institute for National Defence in collaboration with the Institute of Semiconductor Research Stockholm. The present investigation has been made in order to establish the possibilities of the dosimeter for practical applications and to study the variations of important parameters as a function of the production process. In particular the following parameters have been studied: dose sensitivity, energy dependence, fading effect, temperature influence and maximum measurable dose. In general one might conclude that the dosimeter 5422 well fulfills requirements usually specified for a dosimeter for field service. Temperature influence and fading effect are of little practical importance within the recommended range of measurement. Author (ESRO)

N69-18734*# Chrysler Corp., New Orleans, La. Space Div.
RADIATION PROTECTION STUDY FOR PHOTOGRAPHIC SPACE FILM
17 Jan. 1969 57 p refs
(Contract NASw-1741)
(NASA-CR-100016) Avail: CFSTI CSCL 14E

A cobalt 60 source was used to irradiate several types of space photographic film. From the data obtained, characteristic curves were drawn for these films, and a proton-gamma equivalence determined. The effects of variations in the development processing parameters were investigated, and the feasibility of reduced film storage temperature was studied as a means to inhibit film fogging in space. Author

N69-18750# Royal Aircraft Establishment, Farnborough (England).
A SENSITIVE, CONSTANT RESISTANCE, PIRANI GAGE WITH A FAST RESPONSE TIME
H. J. Allsopp, F. J. Bradshaw, R. H. Stanford, and N. J. Wadsworth Jun. 1968 22 p refs
(RAE-TR-68148) Avail: CFSTI

A sensitive Pirani-type gage with good zero stability and a fast response time has been developed. A 10 micron diameter tungsten wire is used in a feed-back circuit which maintains it at constant temperature. The instrument will detect pressure changes of 6×10^{-6} torr at pressures up to 10^{-2} torr falling to $\approx 4 \times 10^{-5}$ torr at 10^{-1} torr, zero drift is less than 10^{-5} torr over periods up to 6 hours and the time constant for response to pressure changes varies from 0.14 sec at 10^{-6} torr to 0.02 sec at 10^{-1} torr. Author (ESRO)

N69-18797# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).
A METHOD FOR CALIBRATING THE MEASURING APPARATUS USED IN LASER SCATTERING EXPERIMENTS ON HOT PLASMAS [EINE METHODE ZUR EICHUNG DER MESSAPPARATUR BEI STREULICHTMESSUNGEN AN HEISSEN PLASMEN]
P. Stoye May 1968 42 p refs In GERMAN; ENGLISH summary
(IPP-1/84) Avail: CFSTI

A device for calibrating the measuring apparatus used in laser scattering experiments on hot plasmas is described. A light pulse from a Kerr-cell pulsed high pressure mercury arc with a pulse shape resembling that of the laser is sent along the same path as the laser pulse, thus eliminating errors of the stationary method of calibration. Relative calibration shows the measuring apparatus to have an error of 10 to 12% as compared to 24 and 31% for absolute calibration. The device is used in scattering experiments for determining the temperature and density of theta pinch plasmas. ESRO

N69-18848# European Space Technology Center, Noordwijk (Netherlands).
CALIBRATION OF THE SOLAR RADIATION LAMPS AT ESTEC
G. Sänger Paris ESRO May 1968 64 p refs
(ESRO-TN-15(ESTEC)) Avail: CFSTI

This paper describes the procedures adopted and gives the results obtained for the calibrations of the solar radiation lamps used in the ESTEC thermal vacuum chambers, HBF 3, for the tests on the ESRO satellites ESRO I, ESRO II, and HEOS. Solar cells were used as detectors for measuring the intensity of the lamps. In HBF 2, which was used for the tests on ESRO I and II, five carbon arc lamps are used as light source; HBF 3, used for the HEOS test, is equipped with 19 xenon arc lamps. The advantages and disadvantages of the detectors used for monitoring, viz thermopiles, blackened copper plates, fluxmeters, solar cells, are discussed. Author (ESRO)

N69-18871 European Organization for Nuclear Research, Geneva (Switzerland).
THE POSSIBILITIES TO IDENTIFY BY MEANS OF COUNTERS THE FAST PARTICLES FROM A 300 GeV ACCELERATOR
G. Danielsson (Stockholm Univ.), B. Englund (Stockholm Univ.), R. Meunier, H. Spighel, J. P. Stroot et al *In its* Util. Studies for a 300 GeV Proton Synchrotron, Vol. 1 30 May 1967 p 357–392 refs (See N69-18851 08-14)
(CERN/ECFA-66/WG2/US-SG4/ALL-1) Avail: CFSTI

Among the effects considered here, we know at present that at least one, the Cerenkov effect, can be used practically to identify particles up to 300 GeV/c. There is some hope that the technical difficulties involved in realizing efficient xenon counters will be solved, but the uncertainties due to Landau fluctuations will remain to decrease efficiency or rejection. The relativistic rise of ionization in very thin materials, and the transition radiation, are both at such a stage of development that at the moment one cannot be sure that they are useful, but they may become important in the future. As a typical example of a counter able to identify particles from a 300 GeV accelerator, the properties of DISC counters are discussed in detail and applications to some specific experiments are presented. Author

N69-18872 Istituto Nazionale di Fisica Nucleare, Milan (Italy).
LOW ENERGY DETECTORS FOR VERY HIGH ENERGY INTERACTIONS
E. Fiorini, M. Piganelli, and A. J. Herz, (CERN) *In* CERN Util. Studies for a 300 GeV Proton Synchrotron, Vol. 1 30 May 1967 p 393–406 refs (See N69-18851 08-11)
(CERN/ECFA-66/WG2/US-SG4/EF-MP-AJH-1; Rept-67/218/5/tn) Avail: CFSTI

In this report we give a brief review of various detectors considered from the point of view of their capability of detecting coherent nuclear recoils with momenta of the order of $m_\pi A^{-1/3}$. For the sake of simplicity we shall treat "visual" techniques, already used in elementary particle physics, and low energy detectors separately. We will then discuss together these last detectors and list briefly some of their possible applications. Author

N69-18891*# Michigan Univ., Ann Arbor. Radio Astronomy Observatory.
INSTRUMENTATION FOR RADIO ASTRONOMY MEASUREMENTS ABOARD THE OGO-5 SPACECRAFT
B. D. Mac Rae 20 Sep. 1968 135 p refs
(Contract NAS5-9099)
(NASA-CR-100157) Avail: CFSTI CSCL 20F

This report describes the design considerations and performance characteristics of a satellite-borne instrumentation system designed to make radio astronomy measurements at eight discrete frequencies from 50 kHz to 3.5 MHz. These measurements are to detect Solar and Jovian radio frequency bursts and to determine the relative average level of cosmic background radiation down to 50 kHz. The instrument was successfully launched aboard the OGO-VI(E) spacecraft on 4 March 1968 into an elliptical orbit having the following approximate parameters: perigee, 292 kilometers; apogee, 147,000 kilometers; inclination to the equator, 31°; period, 63 hours, 25 minutes. The initial data from the instrument looks excellent and the instrument should successfully fulfill its mission. The scientific aspects and results of this program will be published separately. Author

N69-18945*# Perkin-Elmer Corp., Norwalk, Conn.
TWO GAS ATMOSPHERE SENSOR SYSTEM. PHASE 2: DEVELOPMENT Final Report, 15 Nov. 1965–15 Mar. 1966
Frank Briscoe [1968] 290 p refs
(Contract NAS1-6467)
(NASA-CR-66711) Avail: CFSTI CSCL 06B

Detail design and fabrication data are presented on a two gas atmosphere sensing system for accurately measuring the partial pressures of the principal gases in life support systems of future manned spacecraft. Based on photometric techniques the design concept uses an infrared (IR) and an ultraviolet (UV) channel and a total pressure transducer to provide five different measurements (partial pressure of O_2, CO_2, H_2O, N_2, or H_2, and total pressure), and electrical signals proportional to these measurements for monitoring and possible application to cabin atmospheric control systems. Technical difficulty areas are identified as the development of the IR and UV sources, the sample cell design, and the breadboard detail design. Solutions to these problems are discussed. Details are also given on the fabrication and

acceptance testing of four prototype sensors. The performance assessment shows several design deficiencies which must be resolved before the units can be considered fully operational. Recommendations for overcoming these design limitations are proposed. M.G.J.

N69-18953*# Communication and Systems, Inc., Falls Church, Va.
ANALYSIS OF TWO ALTERNATE DAMPING SYSTEMS FOR GEOS GRAVITY GRADIENT STABILIZED SATELLITE
Washington NASA Feb. 1969 137 p refs
(Contract NASw-1503)
(NASA-CR-1282; R-4036-30-1) Avail: CFSTI CSCL 09E

Eddy current rod and magnetically anchored eddy current rod dampers were analyzed to derive the theoretical performance characteristics of each system and to determine which was the more suitable for GEOS satellites. Major operating conditions were simulated, and the two systems were compared as to space flight factors such as altitude and size limitations. It was found that the eddy current rod damper performs considerably better than the magnetically anchored one for polar orbits of 600 n. mi. altitude, but deteriorates more rapidly for non-polar orbits or at higher altitudes. Although this damper could be improved by adding more rods, a significant improvement would require more rods than could be carried on this satellite, but might be possible on other spacecraft. Magnetically anchored dampers are therefore better suited for GEOS; however two factors heretofore unexplored in the laboratory tests should be investigated. One is the fact that the axis of relative rotation between the two major components is generally not stationary with respect to either part. In addition, evidence that only a certain component of the damper generated torque is effective in damping satellite librations has also been found. A.C.R.

N69-19005 Cornell Univ., Ithaca, N. Y.
A FAST STORAGE SYSTEM FOR PULSE-HEIGHT DATA AND EXPERIMENTS ON 31-MILLISECOND Gd-155m
Moshe Etzion (Ph.D. Thesis) 1968 182 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 68-9881

A fast temporary storage system for pulse amplitudes was developed for use in pulse-height analysis of millisecond half-life isomers. The system can store about a thousand pulses and has a uniform dead-time of 5 μsec. The pulse-height resolution is comparable to that of a 128 channel digital pulse height analyzer. The storage device is an electrostatic storage tube using magnetic focussing of deflection for optimum resolution. Pulses are stored as dots of charge along vertical lines, their amplitude being represented by the distance of the dot from a preset baseline. A detailed description of the storage system is included, followed by results of various tests. The ability of the system to operate at counting rates approaching 2×10^5 p/s is demonstrated and spectra are shown for the millisecond isomers. Experiments on 31-millisecond Gd^{165m} are described. Dissert. Abstr.

N69-19061*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EXPERIMENTAL AND THEORETICAL COMPARISON OF THE JPL ACTIVE CAVITY RADIOMETRIC SCALE AND THE INTERNATIONAL PYRHELIOMETRIC SCALE
Richard C. Wilson 1 Feb. 1969 30 p refs
(Contract NAS7-100)
(NASA-CR-100218; JPL-TR-32-1385) Avail: CFSTI CSCL 14B

The Active Cavity Radiometer, a new and accurate standard detector, has been developed for the absolute measurement of optical radiant flux. The Active Cavity Radiometric Scale, defined by the Active Cavity Radiometer, and the International Pyrheliometric Scale, defined by the Angstrom Pyrheliometer, have been compared in a recent experiment. Simultaneous measurements of solar irradiance demonstrated an average systematic difference between the two scales of 2.2% with the measurements on the Active Cavity Radiometric Scale exceeding those on the International Pyrheliometric Scale. An analytical study of the sensitivities of both the Active Cavity Radiometer and the Angstrom Pyrheliometer to common sources of experimental error is presented. The theoretical uncertainty in the Active Cavity Radiometric Scale is found to be ±0.4%, and that of the International Pyrheliometric Scale ±2.6% relative to a scale based upon fundamental thermodynamic principles. Author

N69-19068*# Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.
RESEARCH IN ELECTRICALLY SUPPORTED VACUUM GYROSCOPE. VOLUME 1: SUMMARY Final Report
R. K. Phelps Nov. 1968 21 p
(Contract NAS12-542)
(NASA-CR-86122) Avail: CFSTI CSCL 17G

Performance characteristics, potential, and limitations of electrically supported vacuum gyroscope (ESVG) instruments were analyzed and evaluated in this study. The scope of the investigation was limited to space missions and launch vehicle guidance missions, and the following aspects were considered: (1) drift of the strapped down ESVG; (2) suspension capability and suspension power consumption; and (3) improvement of readout accuracy of the strapped-down ESVG. This volume contains an overview of the documentation and results, intent, and recommendations of the research. K.W.

N69-19069*# Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.
RESEARCH IN ELECTRICALLY SUPPORTED VACUUM GYROSCOPE. VOLUME 2: ELECTRIC TORQUE ON AN ESVG Final Report
G. A. Matchett Nov. 1968 197 p refs
(Contract NAS12-542)
(NASA-CR-86123) Avail: CFSTI CSCL 17G

This volume covers in depth and detail the electric torque mechanism and the formulas which relate drift and the parameters associated with the manufacture of the ESVG. Presented are relevant aspects of the basic electric force and torque theory, the integrals for the force and torque theory over the hexahedral electrode structure, geometrical perturbations due to rotor and electrode assembly, computation and evaluation of the electric torque, and a solution to the elasticity problem of a spinning spherical shell. K.W.

N69-19070*# Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.
RESEARCH IN ELECTRICALLY SUPPORTED VACUUM GYROSCOPE. VOLUME 3: ESVG SUSPENSION RESEARCH Final Report
K. W. Exworthy Nov. 1968 228 p refs
(Contract NAS12-542)
(NASA-CR-86124) Avail: CFSTI CSCL 17G

The suspension mechanization of an ESVG was investigated from a number of standpoints. The main considerations were: (1) power consumption, in particular in a space environment; (2) suspension in a high-acceleration environment; (3) dual-mode suspension systems, i.e. high- and low-acceleration mechanizations together with switching circuitry between the two modes; and (4) interaction between parameters important to drift (e.g. rotor-electrode gap, sum-of-squares suspension) and suspension realizability. The suspension implementation was considered in fundamental terms rather than in terms of new, specific circuits, to give results which have general applicability. The design of a

specific suspension system is highly dependent on the particular application constraints, such as acceleration, power, drift, or size. The material presented here is applicable to the estimation of various parameters which can be realized for a specific set of requirements. Author

N69-19071*# Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.

RESEARCH IN ELECTRICALLY SUPPORTED VACUUM GYROSCOPE. Volume 4: ESVG READOUT ACCURACY IMPROVEMENT RESEARCH Final Report

J. C. Wacker Nov. 1968 132 p refs

(Contract NAS12-542)

(NASA-CR-86125) Avail: CFSTI CSCL 17G

An error analysis was conducted to identify sources in order to improve system error. Pattern line edge uncertainty was identified as the primary limitation of the ESVG readout accuracy. Two types of steps are considered for improving the accuracy: reduction of the effect or amplification of the error through the train of readout logic and the necessary calculations; and reduction of the uncertainty of the pattern line edge itself. With a modest increase in the region of the patterned rotor and a change of readout strategy to one that utilizes three pickoffs when viewing the pattern, a significant reduction in error amplification can be expected. An all-digital clock system and a hybrid phaselock system are considered for the precise definition of the longitude angle separating the points of the pattern lines viewed by the pickoff. The effects of static acceleration, vibration, and angular rotation of the ESVG readout are examined. K.W.

N69-19060# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

AN INTERFEROMETER FOR THE MEASUREMENT OF THE FRESNEL DRAGGING EFFECT ON MICROWAVES BY A DRIFTING ELECTRON PLASMA [EINE MIKROWELLEN-APPARATUR SUR MESSUNG DES MITFUHRUNGSEF-FEKTES IM DRIFTENDEN ELEKTRONENPLASMA]

O. Gehre, H. M. Mayer, and M. Tutter Sep. 1968 20 p refs In GERMAN; ENGLISH summary Supported in part by EURATOM

(IPP-3-79) Avail: CFSTI

An apparatus is described which measures deviations from reciprocity in the propagation of electromagnetic waves travelling through a medium. The medium under test was a plasma. The apparatus was built for 3 cm waves. The minimum detectable phase difference between the two directions was $\approx 2.10^{-3}$ degrees. Author

N69-19169# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Aerodynamics.

THE USE OF A WING TIP ACCELEROMETER AS A WIND TUNNEL BAROMETER OF BUFFET ONSET

Mark Siegel Nov. 1968 25 p ref

(FSN-AD1-01-68.2) Avail: Issuing Activity

Wing tip accelerometer dynamics were monitored during wind tunnel tests as a potential barometer of buffet onset. The results, illustrated in this note with data from 15 runs chosen at random and covering a wing sweep range of $25^\circ \leq \Lambda \leq 68^\circ$, show that the accelerometer is a reliable, accurate, and sensitive monitor of model wing dynamics. The accelerometer consistently displays the same trend with angle of attack as does the trailing edge pressure at the span station where divergence first occurs. Author (ESRO)

N69-19306# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Angewandte Kernphysik.

RECENT PROGRESS IN HIGH PRECISION NUCLEAR SPECTROMETRY WITH SEMICONDUCTOR COUNTERS

F. Horsch, O. Meyer, and W. Michaelis Jul. 1968 15 p refs Presented at the Intern. Symp. on Nucl. Electron., Versailles, France, 10–13 Sep. 1968

(KFK-778; CONF-680906-8) Avail: CFSTI

Recent progress at Karlsruhe in obtaining optimum precision in nuclear spectrometry with semiconductor counters is summarized. New electronic components such as ultra-high precision pulser for nonlinearity correction, digital stabilization and system checkout, and a timing unit which has been designed for spectrometers where optimum energy resolution is of utmost importance are described. Ion implantation techniques are discussed. The characteristics of ion implanted counters are compared with the performance of detectors produced by diffusion or surface barrier techniques. The dependence of window thickness on reverse voltage, ion energy and ion number and the influence of doping concentration and annealing temperature are discussed. New data are given on the performance of the Karlsruhe Ge(Li) anti-Compton spectrometer. A procedure for computer spectrum analysis is sketched very briefly. Author (NSA)

N69-19310# Idaho Nuclear Corp., Idaho Falls.

ICPP FISSIONABLE ISOTOPE MONITOR Status Report

G. L. Booman, J. P. Morgan, W. J. Maeck, H. R. Beard, F. L. Lisman et al Oct. 1968 51 p refs

(Contract AT(10-1)-1230)

(IN-1211) Avail: CFSTI

Design and construction of a prototype instrument for continuous monitoring of fissionable isotope concentrations in processing plant streams is described. Measurements are based on the delayed neutron technique with irradiation of the plane stream by a ^{239}Pu–Be neutron source and detection of delayed neutrons with $^{10}BF_3$ filled tubes. A small general-purpose computer transforms the pulse signals from the $^{10}BF_3$ tubes to fissionable material level through calculations involving input data reflecting sample stream flow rate in the monitor, attenuation of neutron flux by boron or other neutron absorbing material in the stream, and calibration factors. Sensitivity of the prototype instrument is better than 0.001 g/l of ^{235}U. Suggestions are made for an operational model of the fissionable material monitor system for installation on low level waste, plant input, or intermediate streams. Author

N69-19385# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf.

SUMMING Ge(Li)-COMPTON-SPECTROMETER WITH HIGH PEAK-TO-TAIL RATIO

H. Hick and R. Pepelnik Oct. 1968 15 p refs Submitted for publication

(SGAE-PH-76/1968) Avail: CFSTI

The operation and performance of a summing Ge(li)–Ge(Li) Compton spectrometer are described. The geometry and the electronic adjustment have been optimized with respect to best response function. Peak-to-tail ratios of 400 for 662 keV and 360 for 1120 keV energy have been obtained. The construction of a summing Si(Li)–Ge(Li) Compton spectrometer is suggested to avoid small residual contributions of the pair production to the response function. Author

N69-19397# Los Alamos Scientific Lab., N. Mex.

A MULTIPLIER FOR USE WITH E-d-E/dX PARTICLE IDENTIFIERS

W. P. Aiello and S. Singer [1968] 10 p refs Presented at 15th IEEE Nucl. Sci. Symp., Montreal, 23–25 Oct. 1968

(Contract W-7405-ENG-36)

(LA-DC-9626; CONF-681017-7) Avail: CFSTI

The Vela 5 satellite energetic particle experiment will employ and E-dE/dX particle identifier in which the 2-pulse multiplication is performed by a gated, constant current circuit. The multiplication time is proportional to pulse height and varies between 1.5 and 15 microseconds. The multiplier output is a reasonably accurate representation of the product of the input pulses, and is nearly independent of temperature. Author (NSA)

N69-19438*# Honeywell Inc., Minneapolis, Minn. Aerospace Div.
STERILIZABLE WIDE ANGLE GAS BEARING GYRO FGG3345 Progress Report, 1 Jul. 1968–1 Jan. 1969
J. M. Bremer 15 Jan. 1969 16 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951529)
(NASA-CR-100213; JPL-20584-PRB) Avail: CFSTI CSCL 17G

Two gyros were shipped; the fourth was built and has completed sterilization and shock testing. The gimbal assembly for the fifth gyro was completed. Test results of four of the gyros built are tabulated and include those on acceptance testing, elastic restraint compensation, sterilization testing, shock and vibration testing, and environmental testing. B.P.

N69-19474# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.
A PORTABLE CONTAMINATION METER
A. R. Jones Jan. 1969 17 p refs
(AECL-3144) Avail: Atomic Energy of Can., Ltd., Chalk River: $0.50

The electronic and mechanical design, performance, and application of the meter is described. The meter has a linear count rate scale (0 to 1000 counts/minute) useful for locating low level contamination and a quasi-logarithmic scale (0 to 60,000 counts/minute) for measuring contamination levels. It can be connected to a thin walled side or end window Geiger tube. Power is supplied by rechargeable batteries whose state is monitored continuously. It can be connected permanently to the charger for line-powered operation. Author

N69-19498# Japan Atomic Energy Research Inst., Tokyo.
STORAGE COUNTERS USING FET'S
Satoshi Takeuchi and Osamu Nishino (Tokyo Univ.) Dec. 1968 13 p refs
(NSJ-TR-140) Avail: CFSTI

The characteristics, a modification, and uses of a transistorized storage counter are described. The circuit uses a MOS type FET as a memory potential reading element. The memory potential decay rate is better than 0.1%/min. at 30°C, 63% R.H. Because of its simple, compact, and lightweight feature, the circuit will have many uses in nuclear instrumentations. By a modification of the pumping circuit of the storage counter, it can also serve as a pulse integrator for radiation dosimetry. A simple 15 channel pulse height analyzer utilizing the storage counters as memeory devices has been constructed. Author

N69-19516#
ACTINOMETRIC APPARATUS OF SOVIET METEOROLOGICAL EARTH SATELLITES
V. A. Beskin et al [1968] 6 p Trans. into ENGLISH from Tr. Sputnikovaia Meteorol. (Leningrad), v. 221, 1968 p 3–7
Avail: CFSTI

Details are given on the actinometric apparatus for measuring the departing natural radiation of the earth and atmosphere, the departing shortwave radiation reflected by the earth and its atmosphere, and the effective radiation temperature of the earth's surface or the clouds. The apparatus operates in three spectrum ranges: the energy brightness and flux density of the reflected shortwave radiation are measured in the 0.3 to 3μ range; the energy brightness and departing radiation flux density are measured in the 3 to 30μ range; and the effective radiation temperature is determined by measuring the effective brightness in the 8 to 12μ range. Two kinds of actinometric instruments are used: (1) a narrow angle device (brightness meter) with a 4° × 6° instantaneous view field angle for the operating survey angle perpendicular to the satellite flight trajectory of ±66°, and (2) a wide angle device (flux density meter) with a viewing angle of 136° to 140°. Optical diagrams of these devices are included. Author

N69-19536#
MINIATURE HIGH SPEED SPECTROMETER FOR THE 1.5–8 MU INFRARED
V. K. Goncharov et al [1968] 5 p refs Transl. into ENGLISH from Zh. Prikl. Spektr. (USSR), v. 9, no. 6, 1968 p 1065–1069
Avail: CFSTI

A spectrometer model for the 1.8 to 8 μ range was developed and constructed in which an extra-axial parabolic mirror and cooled radiation detector were the transmission optics. The spectrometer permitted recording radiant fluxes with a 10^{-8} w/cm^2 threshold exposure on the entrance pupil in the resolution band of the device. The dynamic range of the device is 100 db. The resolved spectrum band is 0.06 μ. Further research was conducted on reducing the size of the instrument. B.P.

N69-19536#
MINIATURE HIGH SPEED SPECTROMETER FOR THE NEAR INFRARED RANGE 0.8–3 MU
V. K. Goncharov et al [1968] 4 p refs Transl. into ENGLISH from Zh. Prikl. Spektr. (USSR), v. 8, no. 2, 1968 p 356–359
Avail: CFSTI

The near infrared spectrum range is of interest both for spectrum analysis and for low temperature plasma diagnostics. An instrument was developed for high speed spectroscopy measurements in this region. It is of small size and weight, operates automatically, and permits making telemetry measurements. The optical–kinematic diagram of the spectrometer is depicted and its operational procedure is reviewed. B.P.

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N69-19064*# Mobil Research and Development Corp., Paulsboro, N. J. Research Dept.
MICROFOG LUBRICANT APPLICATIONS SYSTEM FOR ADVANCED TURBINE ENGINE COMPONENTS: DETERMINATION OF THE VELOCITIES, PARTICLE SIZE DISTRIBUTIONS, AND WETTABILITIES OF MICROFOG STREAMS OF VARIOUS LUBRICANTS Final Report
J. Shim and S. J. Leonardi 30 Sep. 1968 228 p refs
(Contract NAS3-9400)
(NASA-CR-72489) Avail: CFSTI CSCL 11H

A test apparatus providing a range of conditions such as might be encountered in a once-through microfog lubrication system for the bearings of high speed aircraft, has been employed to determine the velocities, particle size distributions, and wettabilities of microfog streams of various lubricants. Wettabilities are related to size, concentration, and velocity of the microfog particles, temperature of the wetted surface, ambient conditions, geometric considerations, and properties of the lubricants. Author

N69-19424# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
THERMAL-HYDRAULIC AND MECHANICAL ASPECTS OF FTR FUEL PIN SPACER DESIGN
P. D. Cohn, T. J. Bennett, M. A. Fischer et al Oct. 1968 144 p refs
(Contract AT(45-1)-1830)
(BNWL-750) Avail: CFSTI

Detailed analytical and experimental data and current program status of the hydraulic, mechanical, and thermal aspects of the FTR fuel pin and spacer design are presented. The data deal primarily with the wire wrap spacers. A satisfactory grid system has not yet been proposed and therefore cannot be analyzed. The results of the analyses and tests show that the reference wire wrap spacer system for the FTR fuel subassemblies will perform reliably throughout the fuel lifetime. Development of a grid spacer system comparable in performance to the wire wrap can also be expected. Hydraulic and subsequent thermal analyses show temperature gradients caused by excess flow around the assembly perimeter to be severe but acceptable from a mechanical stress standpoint. Another major technical requirement, accommodation of fuel pin diametral growth, was demonstrated both by analytical and experimental data to be adequate for the wire wrap system.
Author (NSA)

N69-19451# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIOISOTOPES IN THE INVESTIGATION OF LUBRICANT PROPERTIES
Yu. S. Zaslavskiy et al 8 Mar. 1968 203 p refs Transl. into ENGLISH of the book "Radioizotopy v Issledovanii Svoistv Smazochnykh Materialov" Moscow, Atomizdat., 1967 p 1–180
(AD-679517; FTD-MT-24-1-68) Avail: CFSTI

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N69-19452# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE MECHANISM OF NEUTRALIZING ACTION OF ADDITIVES TO OILS
In its Radioisotopes in the Invest. of Lubricant Properties 8 Mar. 1968 p 1–20 (See N69-19451 08-15)
Avail: CFSTI

A radioactive tracer apparatus is constructed for determining neutralization effectiveness of additives in motor oils by corrosional wear of the cylinder-piston group in internal combustion engines. During operation of the apparatus friction surfaces of the activated pad and ring surfaces wear out, and products of wear, including atoms of the radioactive isotope Co^{60} enter the oil. Radioactivity counts for the oil in connection with accumulated radioactive metal particles in it give characteristic curves of wear for the rubbing surfaces. Most effective corrosion preventing additives contain cations with the greatest normal electrode potentials. Results show that alkylphenolate additives are most effective in neutralizing counterwear action. G.G.

N69-19453# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION COUNTERWEAR PROPERTIES OF ADDITIVES TO OILS IN CONDITIONS OF ELECTROEROSIONAL WEAR
In its Radioisotopes in the Invest. of Lubricant Properties 8 Mar. 1968 p 21–30 (See N69-19451 08-15)
Avail: CFSTI

Electroerosional wear in internal combustion engines was reduced by the counterwear properties of additives to motor oils. Comparitive data on engine wear during operation on oil with barium alkylphenolate and barium disulfide alkylphenolates showed that barium alkylphenolates provided the greatest duration of neutralization. G.G.

N69-19454# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE MECHANISM OF DETERGENT ACTION OF ADDITIVES TO MOTOR OILS
In its Radioisotopes in the Invest. of Lubricant Properties 8 Mar. 1968 p 31–76 (See N69-19451 08-15)
Avail: CFSTI

The stabilization of carbonaceous suspensions in motor oil by detergent additives showed a definite relationship between the rate of electrophoresis displacement of suspended particles and rate of their coagulation; the higher the speed of electrophoresis, the slower coagulation occurred. Results of motor oil tests with different concentrations of detergents obtained the greatest stabilization by mixing a sulfonate additive and an alkylphenolate additive of formaldehyde condensation. G.G.

N69-19455# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE MECHANISM OF ANTICORROSIVE ACTION OF ADDITIVES TO OILS
In its Radioisotopes in the Invest. of Lubricant Properties 8 Mar. 1968 p 77–113 (See N69-19451 08-15)
Avail: CFSTI

Corrosive destruction of bearings of nonferrous antifriction alloys during operation of internal combustion engines is caused mainly by oil oxidation products, fuel combustion products, and sulfurous compounds. Experiments with anticorrosive additives and their formation of protective films on metal surfaces showed that calcium sulfonates provided the highest anticorrosive effectiveness; this anticorrosive action is based on metal surface film abrasion. G.G.

N69-19456# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE MECHANISM OF ACTION OF COUNTERSEIZING ADDITIVES
In its Radioisotopes in the Invest. of Lubricant Properties 8 Mar. 1968 p 114–160a (See N69-19451 08-15)
Avail: CFSTI

Radioactive tracer methods were used to study the action mechanisms of anticorrosive and counterseizing additives in lubricating oils of friction machines with emphasis on different metals and temperatures. Tests showed that phosphorus containing organic compounds as anticorrosive components together with counterseizing additives sharply reduced corrosion and lowered the chemical wear of rubbing metal surfaces under small loads. G.G.

N69-19457# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CERTAIN PECULIARITIES OF WEAR OF AN INTERNAL COMBUSTION ENGINE WITH THE APPLICATION OF OILS WITH ADDITIVES
In its Radioisotopes in the Invest. of Lubricant Properties 8 Mar. 1968 p 161–172 (See N69-19451 08-15)
Avail: CFSTI

A laboratory radioisotope method of simultaneous investigation of counterwear and detergent properties in motor oils under conditions of oxidation is reported. The oil was heated approximately to 190°C from deposited lacquer and rubbing surfaces during test evaluation in an internal combustion machine. Wear was determined by measuring the radioactivity of the oil before and after the experiment and by determining the quantity of deposed lacquer. Test results for sulfurous motor oils and the same oils with alkali additives show that it is possible to attain a differentiated estimate of additive properties through the described method. G.G.

N69-19458# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE INFLUENCE OF DIFFERENT ADDITIVES ON COUNTERWEAR PROPERTIES OF LIQUIDS FOR HYDRAULIC SYSTEMS
In its Radioisotopes in the Invest. of Lubricant Properties 8 Mar. 1968 p 173–194 refs (See N69-19451 08-15)
Avail: CFSTI

Described are radioactive separation and radiometric determination methods for selecting optimum compositions of liquids with emulsifying, antirust, counterseizing, and counterfoam additives for hydraulic systems. Wear of radioactive blade pump parts, pumping liquid in a hydraulic system on a test stand, is observed by the radioactivity in the test liquid and by comparing the speed of wear of the radioactive metal parts during operation on tested and standard liquids. This method provides for a correct appraisal of counterwear properties of emulsion liquids with different additives. G.G.

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N69-18329 Rochester Univ., N. Y.
BEHAVIOR OF THE PULSED ARGON ION LASER
Thomas Henry Ernest Cottrell (Ph.D. Thesis) 1968 136 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-9365

The output power of pulsed noble gas ion lasers is discussed in terms of dependence on gain, plasma tube length, current density, and excitation mechanisms. Experimental data for most of the strong laser transitions of singly and doubly ionized neon, argon, and krypton in pulsed operation are presented. The resulting power output dependence on current density suggests that two-step excitation plays an important role, particularly in the population of the lower laser levels. This point of view is confirmed by observation of ring formation in the output beam cross section, and of the output power dependence on the 3/2 power of the plasma tube diameter. Dissert. Abstr.

N69-18426*# Ohio State Univ., Columbus. ElectroScience Lab.
ELECTRON BEAM PUMPED LASER ACTION IN SELENIUM AND TELLURIUM WITH APPLICATIONS FOR TUNABLE BACKWARD PARAMETRIC OSCILLATIONS Semiannual Status Report
9 Jan. 1969 27 p refs
(Grant NGR-36-008-103)
(NASA-CR-99789; SASR-2679-1) Avail: CFSTI CSCL 20E

Two methods for the growth of single crystals of selenium are considered: Czochralski and Bridgman methods. Details of experimental procedures and apparatus are presented. It is concluded that the Czochralski method has the potential for growing larger and more perfect crystals than the Bridgman technique. F.O.S.

N69-18486 Rochester Univ., N. Y.
LOSSES IN RUBY LASERS DUE TO CRYSTAL DEVIATION FROM AN IDEAL MEDIUM
Arthur Neil Rosen (Ph.D. Thesis) 1968 136 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-9392

A comprehensive study of the losses in ruby lasers is described. The passive losses (unpumped crystal) were studied with the use of a 6328Å laser probe and a scanning Fabry–Perot interferometer. In the active state (optically pumped crystal), the excited state population was determined by the observation of excited state absorption at 6328 Å, and subsequently used to precisely determine the active laser losses. For representative high quality ruby crystals, passive losses were found to be on the order of 0.03 cm^{-1}, while active losses were approximately twice this value. The losses at 6328Å were predicted theoretically using the Mie scattering cross sections and are in good agreement with the experimental data. In addition, the excited state absorption coefficient from the ^2E level for 8943Å radiation was found to be $\beta' = 0.0 \pm 0.05$ cm^{-1}. Losses due to thermal distortion of the ruby rod were found to be negligible during pulsed operation of the laser. Dissert. Abstr.

N69-18493# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL INVESTIGATION OF THE ATMOSPHERIC ABSORPTION OF GAS LASER RADIATION WITH A WAVELENGTH OF 1.15 μ m
B. A. Antipov et al *In its* News of Inst. of Higher Learning. Phys., Vol. 10, No. 6, 15 May 1968 p 5–8 refs (See N69-18491 08-34)
Avail: CFSTI

The authors measured atmospheric absorption, using a gas laser as the source of radiation. To rule out any possible influence of aerosol scattering on the absorption data, the authors made the measurements under laboratory conditions with the help of a multiple-pass cell. The light path length in the cell could be varied from 3 to 120 m and the pressure from 1 to 760 mm Hg. Air pressure was measured by a U-shaped manometer and a VT-2 vacuum gage and its moisture content by an aspiration psychrometer. The radiation of an HeNe laser (1.15 μm) was measured by the output of a photomultiplier either directly or after its passage through the cell. From the measurements, the authors calculated the transmittance of the nonturbid atmosphere for 1.15 μm laser radiation for light path lengths (L) of 0.1, 0.5, and 1.0 km at absolute humidities of 1, 5, 10, and 15 g/m^3, which correspond to thicknesses of the precipitated water layer of 1, 5, 10, and 15 mm/cm. Author

N69-18494 Utah Univ., Salt Lake City.
ISOTOPE SHIFTS AND cw OSCILLATION IN THE 4416A CADMIUM LASER
Bruce Dexter Hopkins (Ph.D. Thesis) 1968 84 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-12443

This research was primarily concerned with a measurement of the relative isotope shift between cadmium isotopes 112, 114, and 116 utilizing separated isotopes in a metal vapor laser system. The measured values that resulted from this work were as follows: (1) Cd^{112}–Cd^{114} shift, 47.2 ± 1.2 mK; (2) Cd^{114}–Cd^{116}

shift, 34.6 ± 1.2 mK; and (3) Cd^{112}–Cd^{118} shift, 82.5 ± 0.9 mK. In all cases the heavier isotope was shifted toward the high frequencies. During the course of making the isotope-shift measurements, three additional observations were made. First, it was noted that the measured shift between overlapping isotopes tended to be anomalously small under certain experimental conditions. In natural cadmium at relatively high power outputs, the spectral distribution of the laser radiation showed only one peak instead of the expected double-peak corresponding to the two most abundant isotopes. Dissert. Abstr.

N69-18720 Rochester Univ., N. Y.
THE INTERACTION BETWEEN TWO COMPETING WAVELENGTHS IN A LASER
Han-Gie Liem (Ph.D. Thesis) 1968 86 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-9384

The detection of the 3.39-μ line by the 6328-Å line in a He–Ne laser has been derived using the effect of dominance in a three level system. The steady state solution of the rate equations of the population density of each level gives the population inversion for the 6328Åline, which is employed to derive the gain of this line. The presence of the 3.39-μ line in the cavity of a laser oscillating at 6328 Å will reduce the gain, represented by the reduction in the small-signal gain at the atomic line center, at 6328 Å. The output power at 6328 Å is given as a function of the small-signal gain at the atomic line center. Thus, the 3.39-μ line will reduce the output power at 6328 Å. Theroetical calculations of the reduction of the output power using measured values of the A-coefficients agree within 10% with the experimentally measured results. Dissert. Abstr.

N69-18729*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN ADVANCED 10.6-MICRON LASER COMMUNICATION EXPERIMENT
John H. McElroy, Nelson McAvoy, Herbert L. Richard, William E. Richards, and Steven C. Flagiello Nov. 1968 69 p refs
(NASA-TM-X-63441; X-524-68-478) Avail: CFSTI CSCL 20E

The purpose of the proposed laser intersatellite communication experiment is to determine the capability of the carbon dioxide laser to meet the high data rate, intersatellite communication requirements envisioned for the late 1970's and 1980's. The experimental package to be developed consists of a 100 MHz bandwidth communication unit for synchronous satellite to synchronous satellite applications and a 5 MHz bandwidth communication unit for low-altitude satellite to synchronous satellite applications. The proposed development will result in the production of a complete breadboard communication system, in near space-qualified form, that will be available in 1972 for use in appropriate spacecraft during the 1970's. The system will be developed to the point that placing the experimental package on a given satellite will consist primarily of space-qualification, packaging, interfacing the system to the spacecraft, and test and evaluation. Author

N69-18736# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
ON A LOW-FREQUENCY MASER AMPLIFIER [ETUDE D'UN AMPLIFICATEUR MASER BASSE-FREQUENCE]
Henri Pépin 1968 135 p refs In FRENCH; ENGLISH summary
(ONERA-P-125) Avail: CFSTI

The low frequency Maser amplifier considered is based on the dynamic polarization of the protons of a solution containing free radicals. This Maser is intended to replace the conventional devices used to amplify signals originated by very low internal resistance sources. To ensure physical measurements a linear autodyne spectrometer has been developed. With this device one can measure directly the negative resistance due to the Maser effect. When very close to the conditions of Maser auto-oscillations. In this respect its possibilities are broader than those of existing spectrometers. The physical factors interesting the realization of the Maser are evaluated and optimized, as well as its electronic and technological elements. The study shows that it is necessary to use a system of liquid circulation. The efficiency of this system itself and the influence of the type of flow, are particularly analyzed. The evaluation of the performance obtained leads to the determination of the improvements necessary to obtain an operational Maser. Author (ESRO)

N69-18771# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEWS OF INSTITUTIONS OF HIGHER LEARNING. PHYSICS, VOLUME 10, NUMBER 8 Selected Articles
M. V. Kabanov et al 15 May 1968 17 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (Tomsk), v. 10, no. 8, 1967 p 26–30, 142–144
(AD-679802; FTD-HT-23-251-68) Avail: CFSTI CSCL 20/5

CONTENTS:

1. ATTENUATION OF COLLIMATED LIGHT BEAMS IN DISPERSIVE MEDIA M. V. Kabanov p 1–7 refs (See N69-18772 08-16)

2. ATTENUATION OF LASER BEAMS IN ARTIFICIAL WATER FOGS V. I. Bukatyy et al p 8–12 refs (See N69-18773 08-16)

N69-18772# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ATTENUATION OF COLLIMATED LIGHT BEAMS IN DISPERSIVE MEDIA
M. V. Kabanov *In its* News of Inst. of Higher Learning. Phys. Vol. 10, No. 8 15 May 1968 p 1–7 refs (See N69-18771 08-16)
Avail: CFSTI

This work examines the effect of singly and laterally scattered light on the attenuation of collimated light beams in turbid media. Formulas are obtained for corrections to the exponential law of attenuation for the case when the angle of vision of the receiver and the angle of divergence of the source are identical. Regions are found in which the corrections are significant for the propagation of light beams in haze, fog, and rain. It is shown that the region of solid angles in which the angular dependence of scattered light can be disregarded is determined by the inequality $\rho\omega \leq 1.1$, where ρ is the Mie parameter; the solid angle ω determines the divergence of the light beam, which in this case is equal to the angle of vision of the receiver. Author

N69-18773# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ATTENUATION OF LASER BEAMS IN ARTIFICIAL WATER FOGS
V. I. Bukatyy et al *In its* News of Inst. of Higher Learning. Phys., Vol. 10, No. 8 15 May 1968 p 8–12 refs (See N69-18771 08-16)
Avail: CFSTI

An experimental investigation is made of the transmission of various types of laser beams with respect to their attenuation characteristics in water-vapor fogs. Ruby (λ = 0.69 μ), neodymium glass (λ = 1.06 μ), and He–Ne gas (λ = 0.63, 1, 15, and 3.39 μ) lasers were tested under cw and pulsed multimode conditions. A fog chamber was used for the measurements. The attenuation data in the fog chamber were compared to those in clear air over the same distance of propagation. The transmissivity of the same fog medium to the thermal radiation of an incandescent lamp in the

0.44-μ range was measured simultaneously for data comparison. All measurements showed a consistant proportionality between the attenuation of laser beams and thermal radiation, with a ratio close to unity. The slight deviations of the ratio from unity are ascribed to systematic measurement errors. Author

N69-18876# Signals Research and Development Establishment, Christchurch (England).
A LOW DRIVE-POWER LIGHT MODULATOR USING A READILY AVAILABLE MATERIAL ADP
M. Dore May 1968 14 p refs
(SRDE-68009) Avail: CFSTI

A video-frequency transverse electrooptic light amplitude modulator utilizing the matrix element r_{41} in ADP is described and compared favorably with other modulator configurations using ADP, KDP, and KD*P. It utilizes two crystals to compensate for temperature and angular dependences of birefringence, and has more than adequate stability for normal laboratory use. A useful built-in optical bias control is provided. Frequency response has been measured between 50 Hz and 5 MHz and found to be flat. Video signals have been transmitted over a laser communication link using only 50-volt peak-to-peak drive. Half-wave voltage is 220 volts and capacity is 53 pF, giving a drive-power requirement of 2.6 watts per MHz of bandwidth for 100-percent modulation depth, or 290 mW for 50-percent modulation depth. Optical transmission was 70 percent achieved by using an index matching liquid. An extinction ratio of 30:1 was obtained using a laser light source. Author (ESRO)

N69-19218# California Univ., Livermore. Lawrence Radiation Lab.
OBSERVATION OF NEUTRONS FROM THE ACTION OF A GIANT LASER PULSE FOCUSSED ON THE SURFACE OF LITHIUM DEUTERIDE
N. G. Basov et al Oct. 1968 12 p refs Transl. into ENGLISH from Russian Presented at the IEEE Quantum-Electron. Conf., Miami, May 1968 *Its* Preprint No. 63
(UCRL-Trans-10287) Avail: CFSTI

The experimental apparatus for producing and detecting the neutrons is described. Preliminary results are described. NSA

N69-19244# Rochester Univ., N. Y. Dept. of Electrical Engineering.
INVESTIGATION OF OPERATIONAL POSSIBILITY OF LASER RADIATION IN PARTIAL COHERENCE REGION
Final Report, 1 Sep. 1964–29 Feb. 1968
Hideya Gamo and Thomas J. Walter 28 Jun. 1968 318 p refs
(Contracts AF 19(628)-4350; ARPA-DA-ARO-D-31)
(AD-678554; AFCRL-68-0354) Avail: CFSTI CSCL 20/5

An on-line real time digital data acquisition system has been developed and used to study the higher order statistics of superradiant radiation. Measurements of the statistical moments through the 8th and power spectral measurements to 1.5 MHz are operational. A method of determining the natural and doppler linewidths from a plane parallel Fabry Perot interferometer has been extended to a confocal instrument. The confocal interferometer is shown to have certain advantages over the plane parallel instrument and a graphical method is presented for easy calculation of the pertinent quantities from the interferometer response curve. The above instrumentation has been used to measure the properties of superradiant radiation of the HeXe 3.5 micron line under both linear and saturated amplification. The variance, skew and excess of the intensity fluctuations with statistically reliable data have been measured. Measurements confirm the basic intensity squared dependence of the variance of linearly amplified spontaneous emission (superradiance). Under saturated conditions, however, the variance tends to increase more rapidly than for the linear case. The excess, representing the departure of the intensity fluctuations from the Gaussian, is shown to exhibit considerable structure. The tendency is for the excess to rise with additional amplification and then fall, eventually changing sign. Author (TAB)

N69-19495 National Lending Library for Science and Technology, Boston Spa (England).
SOME PROPERTIES AND APPLICATIONS OF GAS LASERS
F. Petru et al 14 Nov. 1968 37 p refs Transl. into ENGLISH from Slaboproudy Obzor (Prague), v. 29, no. 1, 1968 p 6–16 In ENGLISH and CZECH
(NLL-EE-Trans-1829-(3774.5)) Avail: Natl. Lending Library, Boston Spa, Engl.

The properties of gas lasers required in various applications are discussed. Measuring techniques, such as output radiation power, its stability and noise, the frequency properties and frequency stability are considered. Applications of gas lasers in interferometric measurements are described, and some experimental results are given. Author

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N69-18518# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AIRCRAFT CONSTRUCTION AND AVIATION TECHNOLOGY (SELECTED ARTICLES)
4 Jan. 1968 15 p refs Transl. into ENGLISH from Samoetostroyeniye i Tekhn. Vozdushnogo Flota (USSR), no. 5, 1966 p 138–142, 154–156
(AD-679662; FTD-HT-23-1305-67) Avail: CFSTI CSCL 13/8

CONTENTS:

1. A STUDY OF SHAPING PROCESSES IN THE PRODUCTION OF AVIATION CONDUIT FLANGES A. A. Leleta p 1–5 refs (See N69-18519 08-17)
2. ELECTRON-BEAM HEATING IN THE FORMING OF SHEET MATERIALS O. G. Korol' p 6–8 refs (See N69-18520 08-17)

N69-18519# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A STUDY OF SHAPING PROCESSES IN THE PRODUCTION OF AVIATION CONDUIT FLANGES
A. A. Leleta *In its* Aircraft Construct. and Aviation Technol. 4 Jan. 1968 p 1–5 refs (See N69-18518 08-17)
Avail: CFSTI

This paper examines the axisymmetric problem of the use of expansion or compression to form flanges on pipes that can be connected to a main without additional machining. The change in the state of the metal is assumed to be isothermal, and the motion is assumed to be so slow that the effect of inertial forces can be considered negligible as compared with internal friction. An example of deformation of a tubular blank described by the to be isothermal, and the motion is assumed to be so slow that the effect of inertial forces can be considered negligible as compared with internal friction. An example of deformation of a tubular blank described by the equation $\psi = Cz^2$ is given. The velocity field of metal-particle flow, the deformation rates, the rigidity coefficient, and the stress are calculated.

N69-18520# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ELECTRON-BEAM HEATING IN THE FORMING OF SHEET MATERIALS

O. G. Korol *In its* Aircraft Construct. and Aviation Technol. 4 Jan. 1968 p 6–8 refs (See N69-18518 08-17)

Avail: CFSTI

The possibility of electron-beam heating during sheet-metal forming has been investigated. The simplest electron-beam forming gun consists of a cathode emitting electrons, controlling electrode and anode. Focusing is done by means of a magnetic lens. The beam can be deflected vertically and horizontally by means of coils. The advantages of electron-beam heating are: the energy and direction of electron beam can be easily controlled; heating of metal is done, not at the surface, but at a predetermined depth; and the heating process can be accelerated due to the high density of energy obtainable from the electron beam. Calculations showed that with a beam current of 100 mA and an accelerating voltage of 20,000 V, a steel plate 1 mm thick and 50 cm 2 in area can be heated to 1000°C in 40 seconds. Author

N69-18528 Rensselaer Polytechnic Inst., Troy, N. Y.

ULTRASONIC DETECTION OF THE MIGRATION OF POINT DEFECTS IN LEAD

Dae-Shik Woo (Ph.D. Thesis) 1968 159 p

Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-13531

The migration of point defects in single crystal samples of 99.999% pure lead has been detected by ultrasonic attenuation. The defects were produced by Co^{60} gamma rays at liquid nitrogen temperature. In the irradiated specimen, isochronal anneals to 270°K produced attenuation minima at 160 and 230°K, whereas the un-irradiated specimen had a minimum only at 220°K. A series of isothermal anneals was performed to obtain the energy of migration. The results are interpreted by Granato–Lücke theory by assuming that the point defects produced pin the dislocation. A model for defect migration in lead is proposed. It is assumed that a gamma ray penetrates the crystal and creates a Frenkel pair by a Compton electron process. The defects diffuse to dislocation by a random walk process. Once the defect is on the dislocation segment it migrates along the dislocation by a unit jump process and during this process it may jump back to the lattice or migrate along the dislocation in a random fashion and possibly collide with a trap. Dissert. Abstr.

N69-18595 National Lending Library for Science and Technology, Boston Spa (England).

SULPHIDE CORROSION CRACKS IN HIGH-TENSILE STEEL IN CHEMICAL PLANTS, CAUSED BY HYDROGEN SULPHIDE

M. Watanabe et al [1968] 23 p refs Transl. into ENGLISH from Schweisstechnik (Berlin), v. 17, no. 7, 1967 p 298–305 (NLL-M-7500-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

Problems of sulfide corrosion cracks in high tensile steel and methods of correcting the failures were investigated in view of the increased use of such steels for oil refinery tanks and containers. Laboratory and performance tests on oil refinery tanks under operational conditions were conducted. The laboratory tests studied specially developed steel and welded specimens by immersing them under constant tensile load in 0.5% acetic acid solution containing dissolved H_2S. Laboratory results indicated a definite relationship between tensile strength and resultant embrittlement and sulfide corrosion cracking, with cracking particularly noticeable in the case of welds. It also appears possible to mitigate cracking in heat affected zones of welded joints by slowing the cooling rate. Cold working up to 15% reduction increases crack susceptibility; increasing H_2S concentration lowers the limit stress. Operational tests confirmed the assumption that no risk of cracking exists with an H_2S concentration in water of less than 100 ppm, although this concentration could cause safety problems. Otherwise, results of operational and laboratory tests do not generally agree except for the welded specimens. A.C.R.

N69-18597 National Lending Library fo. Science and Technology, Boston Spa (England).

THE RISK OF FRICTIONAL SPARKS BEING PRODUCED FROM LIGHT ALLOYS USED IN AREAS WHERE AN EXPLOSION HAZARD DUE TO GASES AND VAPORS EXISTS [OTAZKY NEBEZPECI VZNIKU MECHANICKO JISKRY PRI POUZITI SLITIN LEHKYCH KOVU V PROSTORECH NEBESPECNYCH VYBUCHEM PLYNU A PAR]

M. Balek et al 10 Dec. 1968 52 p refs Transl. into ENGLISH from Zprava Vedeckovyzkumny Uhelny Ustav (Czech.), no. 49, 1966

(NLL-SMRE-Trans-5539-(8313.4)) Avail: Natl. Lending Library, Boston Spa, Engl.

Mine safety is discussed as related to the danger of explosion caused by the contact of light alloy construction materials with steel in the gaseous methane environment. Factors influencing ignition probability in an explosive mixture of methane gas during drop tests are examined, and results are presented for rotary tests with interrupted sliding. It was found from the drop tests that normalized casting alloys with unfinished surfaces can be divided into three basic groups according to ignition probability. Alloys of magnesium composition were found to be the most dangerous, while the alloy Al–Si (87:13) seems suitable. In addition, the need for improved surface protection methods was emphasized, and it was suggested that mixtures heretofore excluded due to ignitability might be applicable if these methods were successful. Interrupted sliding tests indicated that mutual contact of light alloys, or that of light alloys with steel, is safer than contact of sliding of steel on steel. For rotary equipment, it also appears that bronze and brass are also usable, particularly for equipment operating at high temperatures. A.C.R.

N69-18705# Hawker Siddeley Aviation, Ltd., London (England).

MECHANICAL PROPERTIES OF THIN GAGE FIRTH VICKERS F.V. 520.: A CONTROLLED TRANSFORMATION STAINLESS STEEL MATERIAL

London Min. of Technol. Sep. 1968 137 p refs

(Contract KS/0194/CB.43(A)2)

(S/T-MEMO-4/68) Avail: CFSTI

Details and results of tension, compression dynamic modulus, bend, fracture, creep and fatigue tests on the steel in the following conditions are given: supplied austenitic (fully soft), hardened by sub-zero transformation, followed by precipitation heat treatment; as supplied after transformation on the strip mill production line, hardened by a low temperature treatment followed by precipitation heat treatment; austenitic FV 520 hardened by sub-zero transformation, cold rolled and precipitated to UTS of 75-90 tonf/sq. in.; austenitic FV 20 cold rolled transformed and precipitated to give UTS of about 90 tonf/sq. in.; austenitic FV 520 transformed by conditioning at 750 deg.C followed by precipitation heat treatment. Author (ESRO)

N69-18815# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.

COMPATIBILITY OF VARIOUS MAGNESIUM ALLOYS WITH PRESSURIZED CARBON DIOXIDE AT HIGH TEMPERATURES [COMPATIBILITE DE DIVERS ALLIAGES DE MAGNESIUM AVEC LE GAZ CARBONIQUE SOUS PRESSION AUX TEMPERATURES ELEVEES]

Bernard Dewanckel, René David, Christiane Hulin, and Daniel Leclercq Nov. 1968 61 p refs In FRENCH; ENGLISH summary

(CEA-R-3625) Avail: CFSTI

This work on the compatibility of magnesium alloys with pressurized carbon dioxide has been carried out in three different ways: (a) testing of special alloys containing zirconium, manganese, cerium, zinc, beryllium and yttrium ; their corrosion kinetics often being comparable to those of conventional magnesium-zirconium alloy (b) influence of the quality of the carbon dioxide from which it appears that oxidation is reduced if the carbon dioxide contains traces of water vapor, but is more pronounced if carbon monoxide is also present ; (c) study of certain phenomena related to corrosion such as size changes in the samples during tests, structural modifications in the alloys (grain-size changes, formation of a cortical zone in the case of alloys containing zirconium). Thermal cycling was studied. Comparison of the behavior of various alloys under varying long term conditions permits one to select the most suitable for a given application. Author (ESRO)

N69-18834# Fabrique Nationale d'Armes de Guerre, Herstal-les-Liege (Belgium). Lab. Central.

SOLID SOLUTION AND GRAIN GROWTH TREND IN U.500 [MISE EN SOLUTION ET PROPENSION AU GROSSISSEMENT DU GRAIN D L'U.500]

24 Apr. 1967 13 p In FRENCH

Avail: CFSTI

The results of a study of the temperature at which the gg' phase of $Ni_3(Al-Ti)$ comes into solid solution are presented. The temperature at which the intergranular phases responsible for the hardening of U.50 are formed and the effect of the solid solutions of the different phases on the grain growth of this alloy during heat treatment are also discussed. ESRO

N69-18837# Reactor Centrum Nederland, Petten.

CORROSION OF ZIRCONIUM ALLOY SAMPLES IN 340°C CIRCULATING WATER BEFORE AND AFTER THE PERFORMANCE OF A DECONTAMINATION TREATMENT

A. van der Linde 21 Aug. 1968 28 p refs Presented at the Zirconium 1968 Symp., Pizen, Czechoslovakia, 1–3 Oct. 1968

(RCN-100) Avail: CFSTI

Nine sets of Zircaloy-2, eleven sets of Zircaloy-2, three sets of Zr-2.5 Nb and two sets of Zr-3Nb-I Sn samples, mainly tube specimens, have been exposed in an out-of-pile water loop for up to 650 days. The loop test conditions were: 340°C, pH 9-10 with ammonia, oxygen 0.1-0.2 ppm and hydrogen 0.15-0.35 ppm. The measured weight gain data show that the RCN Zircaloy oxidation relations, obtained from autoclave experiments, can be used for long time exposure calculations of the weight gains in circulating water. After an accidental contamination a two step Turco decontamination treatment was given to all samples. The influence of this treatment on the weight gain rate and on the deviations of measured from calculated weight gain is presented and discussed. Author (ESRO)

N69-18842# Hawker Siddeley Aviation, Ltd., Brough (England). Materials Lab.

EVALUATION OF HARD ANODIZING AS A WEAR RESISTANT COATING FOR ALUMINUM ALLOYS WITH PARTICULAR REFERENCE TO ITS USE AS A SUBSTRATE FOR SOLID PHASE LUBRICANTS

D. Keyworth Min. of Technol. Jun. 1968 148 p refs Supersedes TIL-BR-12 035

(Contract KS/1/292/CB-43(a)2)

(S/T-MEMO-6/68; TIL-BR-12035) Avail: CFSTI

Describes investigations of: Comparison of major types of hard anodic film; examination of abrasion resistance; wear resistance with various surface treatments, with or without solid phase lubricant; measurement of coefficient of friction when suitable lubricants are added; measurement of bearing properties on films of various thicknesses; effect on fatigue properties of shot-peening, surface finishing prior to anodizing and various sealing treatments after anodizing; corrosion resistance when film is sealed with various solid phase lubricants and in contact with various materials. Alloys considered were Al-Cu-Mg alloy, Al-Cu-Ni alloy and Al-Zn-Mg alloy. The addendum gives detailed results of corrosion tests on hard anodized aluminum alloys in marine and industrial atmosphere. Author (ESRO)

N69-18952*# United Aircraft Corp., East Hartford, Conn.

PROPERTIES OF HIGH EMITTANCE MATERIALS

R. E. Cleary, R. Emanuelson, W. Luoma, and C. Ammann Washington NASA Feb. 1969 139 p refs

(Contract NAS3-4174)

(NASA-CR-1278) Avail: CFSTI CSCL 11F

Results of a four year program to determine the suitability of selected high emittance materials for use as coatings on beryllium, Nb–1Zr, and AISI-310 stainless steels used in space power plant radiators are presented. Materials coated on beryllium included calcium, iron, and zirconium titanate, anodized beryllium, and aluminum oxide–aluminum titanate. Specimens were aged in vacuum at 800°, 1200°, and 1400°F for periods up to 1000 hours. The first three titanates were found to be compatible with beryllium for at least 1000 hours up to 1200°F, but the latter two coatings did not perform well. Long term emittance tests were conducted on calcium and iron titanate coated AISA-310 stainless steel, iron titanate coated Nb–1Zr, and Nb–1Zr coated with aluminum oxide–aluminum titanate. The stainless steel specimens were heated in vacuum to 1350°F for 20,000 hours, and the Nb–1Zr specimens were vacuum tested at 1700°F for 10,000 hours; all were thermally cycled to room temperature once a week. Varying degrees of stable emittance, bond strength, coating structure, and diffusion of coating constituents were found in the specimens as a function of hours tested, temperatures used, and thermal cycling. A.C.R.

N69-19002*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

COMPATIBILITY OF METALS WITH HYDROGEN

C. E. Cataldo 26 Dec. 1968 24 p refs

(NASA-TM-X-53807) Avail: CFSTI CSCL 11F

This report summarizes three different but related categories of hydrogen embrittlement problems encountered in various components of Saturn launch vehicle hardware. The status of research programs, established to investigate these failure mechanisms and solutions to prevent failures, is presented. Corrective actions taken to minimize failures from high pressure hydrogen effects, the formation of hydrides in titanium, and hydrogen absorption through various metals processing techniques are described. Author

N69-19085# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf, Inst. fuer Metallurgie.

INERT GAS DIFFUSION IN LIGHT METALS [EDELGASFISSUSION IN LEICHTMETALLEN]

E. Tutschek, P. Koss, and J. Zika 1968 14 p refs In GERMAN Presented at 5th Intern. Leichtmetalltagung, Leoben, Austria, 1968

(SGAE-M-20/1968) Avail: CFSTI

Studied was the diffusion of xenon 133 in aluminum by measuring the isotopic release rate during linear increasing metal temperatures. Xenon volume diffusion in the metal lattice was characterized by atom ionization and substitution into adjacent holes; this plastic deformation resulted in a pronounced diffusion coefficient increase and decreased activation energy for the overall process. Recrystallization studies together with xenon release rates give qualitative and quantitative results on rare gas diffusion mechanisms in light metals. Transl. by G.G.

N69-19121*# IIT Research Inst., Chicago, Ill.
METAL CARBIDE-GRAPHITE COMPOSITES
Yoshiro Harada 23 Dec. 1968 26 p refs
(Contract NASr-65(09))
(NASA-CR-100023; IITRI-G6003-Q9) Avail: CFSTI CSCL 11D

The use of low-melting additives as densification aids is studied to normalize the fabrication process by lowering temperatures to 3000° C or lower and to improve composite properties. This report describes initial studies on the use of tungsten in NbC-C composites. Composites containing 25, 50, and 75 volt/% NbC were fabricated as the standards against which additive-containing composites could be evaluated. Additive composites of the NbC-WC-C systems containing from 25 to 75 vol/% total carbides were then hot pressed for examination both at room temperature and at high temperatures. Detailed results are presented which suggest a good potential for lowering the fabrication temperature and for improving the composite properties. K.W.

N69-19127# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
EFFECTS OF IRRADIATION ON THE STRUCTURE AND PROPERTIES OF STAINLESS STEEL
A. L. Bement, H. R. Brager, T. T. Claudson, J. J. Holmes, and K. R. Merckx 30 Aug. 1968 43 p refs Presented at Fundamental Properties of Mater. and Nucl. Fuel Assemblies, Schenectady, N. Y.
(Contract AT(45-1)-1830)
(BNWL-SA-1876) Avail: CFSTI

Three separate experimental and analytical methods are described for investigating the consequence of fast reactor neutron damage on the performance and reliability of mixed-oxide fuel elements clad with austenitic stainless steel. The first phase involves the examination and description of radiation-induced defect states, such as polyhedral voids and sessile loops, and the correlation of this damage with mechanical properties. The second phase involves model development, using theoretical models and finite-lattice computer calculations, to describe the mechanisms of void nucleation and growth and to develop a procedure for extrapolate volume swelling caused by these voids to end-of-life clad fluences. The third phase is a systems modeling of the fuel model, and provides a means for calculating stress and strain distributions, for testing the validity of creep and swelling models for both fuel and cladding, and for statistically assessing the reliability of full performance against a failure model. Author (NSA)

N69-19142# Michigan State Univ., East Lansing. Dept. of Physics.
QUENCHING PLATINUM AND TUNGSTEN IN SUPERFLUID HELIUM
Ronald Gripshover, John Zetts, and Jack Base Aug. 1968 7 p refs
(Contract AT(11-1)-1247)
(COO-1247-13) Avail: CFSTI

Quenches were carried out on platinum wires in various liquids and in superfluid helium, and tungsten wires in superfluid helium. At high temperatures, the resistivities quenched into fine platinum wires cooled in superfluid helium are consistent with those quenched into larger wires plunged into water and kerosene. However, there is reason to believe that the platinum and helium interact in a manner which does affect the results obtained. The resistivities quenched into high-purity 0.001- and 0.0012-inch dia tungsten wires ($R_{273°K}/R_{4.2°K} > 600$) are comparable to Schultz's published results. However, some differences do exist. Author (NSA)

N69-19148*# Solar, San Diego, Calif.
EVALUATION OF COATINGS FOR COBALT AND NICKEL BASE SUPERALLOYS, VOLUME 1 Final report
V. S. Moore, W. D. Brentnall, and A. R. Stetson 31 Jan. 1969 283 p refs
(Contract NAS3-9401)
(NASA-CR-72359; RDR-1474-2) Avail: CFSTI CSCL 11C

The rate of failure of commercially available coatings on two nickel-base and two cobalt-base alloys under oxidation-erosion conditions in combustion products of JP-5 fuel and air at Mach 0.85 was studied. Three coatings per alloy were included. Extensive characterization of the coatings preceded and followed oxidation-erosion testing. Characterization tests included weight gain and thickness measurements, X-ray diffraction, metallographic studies, and electron beam microprobe analyses. Comprehensive analytical data on coated specimens exposed for 100 hours at maximum blade temperatures of approximately 2075 and 2140°F are included in the report. Weight change data only are included for long-term tests at 1900 and 2000°F on nickel-base alloys and 2000°F on cobalt-base alloys. The coatings evaluated were all basically nickel or cobalt aluminides formed by reacting the substrates with aluminum. Several were the duplex type in that elements such as chromium were applied either before or after the aluminum, e.g., Coatings D, G, J, and O (chromium) or had elements codeposited with aluminum, e.g., Coatings C and F (silicon) and Coatings H and L (titanium). All of the coatings were heavily modified by interdiffusion with the substrate elements. Author

N69-19149# Bureau of Mines, Boulder City, Nev. Metallurgy Research Lab.
BENEFICIATION OF FERROCHROMIUM BY MOLTEN SALT ELECTROLYSIS
Francis R. Cattoir and T. A. Sullivan Feb. 1969 30 p refs
(BM-RI-7226) Avail: Issuing Activity

Experiments were conducted to investigate molten salt electrorefining for beneficiation low-grade, high-carbon ferrochromium products which can be readily produced from domestic chromite concentrates. Another objective was to refine commercial ferrochromium into low-iron chromium products. Electrorefining of both types of ferrochromium in molten $CaCl_2$–NaCl–$CrCl_2$, $CaCl_2$–$MgCl_2$–$CrCl_2$, or KCl–LiCl–$CrCl_2$ electrolytes produced chromium iron products with virtual elimination of other impurity elements and some lowering of the iron content. Over 90 percent of the chromium present in the feed materials was recovered. The electrodeposited products were upgraded further by magnetic separation techniques into chromium present in the recovered. The electrodeposited products were upgraded further by magnetic separation techniques into chromium containing less than 5 percent iron. The technical feasibility of preparing a premium chromium product from a low-grade, high-carbon ferrochromium made from domestic chromite was demonstrated. Chromium, virtually free of carbon, oxygen, and silicon from high-carbon ferrochromiums, was produced. In addition, the amenability of three commercial grades of ferrochromium to electrorefining and magnetic separation for preparing chromium metal containing less than 5 percent iron was determined. Author

N69-19152*# Boeing Co., Seattle, Wash. Aerospace Group.
EFFECT OF PRESSURIZED HYDROGEN UPON INCONEL 718 AND 2219 ALUMINUM
P. M. Lorenz 14 Feb. 1969 152 p refs Prepared for JPL and Calif. Univ., Berkeley
(Contract NAS7-100)
(NASA-CR-100208; D2-114417-1) Avail: CFSTI CSCL 11F

Inconel 718 and 2219-T8E46 aluminum were tested in the environment of pressurized high purity hydrogen gas using surface flawed fracture toughness specimens and preflawed Inconel 718 pressure vessels. All tests were conducted at room temperature.

Presence of pressurized hydrogen gas severely affected flaw growth characteristics of Inconel 718, but had no detectable effect upon 2219-T6E46 aluminum. Base metal and weldments of 2219-T6E46 aluminum retained their load carrying capability in pressurized hydrogen gas at stress intensity levels of more than 90 percent of their respective fracture toughness values. The 2219-T6E46 aluminum was recommended as a substitute for pressure vessels containing hydrogen gas. Author

N69-19200*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPLORATORY STUDY OF MECHANICAL PROPERTIES AND HEAT TREATMENT OF MOLYBDENUM-HAFNIUM-CARBON ALLOYS

Peter L. Raffo Washington Feb. 1969 44 p refs
(NASA-TN-D-5025) Avail: CFSTI CSCL 11F

A preliminary study was made of the structure and properties of Mo–Hf–C alloys. The compositions of the alloys ranged from 0.09 to 1.83 atomic percent Hf and 0.29 to 1.07 atomic percent C. The mechanical properties of these alloys were measured in the as-swaged, recrystallized, solution-treated, and aged conditions at room temperature and 1500° to 3000°F (1088 to 1922°K). The mechanical properties were compared with data on other molybdenum alloys the literature, and two commercial molybdenum alloys that were evaluated during this program. The Mo–Hf–C alloys show a strength advantage over the other alloys in creep-rupture tests at 2400°F (1588°K) and short-time tensile tests at 3000°F (1922°K). Author

N69-19203*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

TENSILE PROPERTIES AND CREEP STRENGTH OF THREE ALUMINUM ALLOYS EXPOSED UP TO 25000 HOURS AT 200 DEG TO 400 DEG F (370 DEG TO 480 DEG K)

Dick M. Royster Washington Jan. 1969 44 p refs
(NASA-TN-D-5010) Avail: CFSTI CSCL 11F

The tensile properties and creep strength of three aluminum-alloy sheet materials exposed up to 25000 hours at 200° to 400° F were investigated. The materials investigated were clad 2024–T81, X2020–T6, and clad RR–58 aluminum alloys. These alloys are representative of the types considered for a supersonic transport operating in the Mach 2 speed range. The effect of longtime, elevated-temperature exposures was determined from changes in tensile and notch properties at room temperature. The short-time, elevated-temperature tensile properties as well as the tensile stress required to produce 0.1-percent creep were determined. Metallurgical studies were made to determine micro-structural changes in the alloys due to exposure. With the exception of the X2020–T6 alloy, the material tensile properties were not severely affected by longtime unstressed exposure. The X2020–T6 alloy also exhibited poor notch toughness. Low creep strength in the aluminum alloys at temperatures above 300° F may limit their use for longtime exposures. Author

N69-19211# Sandia Corp., Albuquerque, N. Mex.

ION PLATING

D. M. Mattox Nov. 1968 16 p refs
(SC-R-68-1865) Avail: CFSTI

A generalized description of the "Ion Plating" process is given, along with its various modifications. The uses and limitations of the process are outlined. The process has been shown to be a useful tool to the laboratory and production technologist. The technique utilizes equipment which is normally associated with the vacuum and sputtering technologies and is, therefore, an easy tool to acquire. A bibliography of pertinent publications is included. Author (NSA)

N69-19215# Kernforschungsanlage, Karlsruhe (West Germany). Institut fuer Material- und Festkoerperforschung.

CREEP RUPTURE STRENGTH AND CREEP BEHAVIOR OF VANADIUM–TITANIUM AND VANADIUM–TITANIUM–NIOBIUM ALLOYS

H. Boehm et al Jun. 1968 65 p refs Transl. into ENGLISH from German Rept. KFK-774 Work performed under US-Euratom Fast Reactor Exchange Program
(EURFNR-534; EUR-3954; KFK-774) Avail: CFSTI

Studies were performed on the creep rupture and creep behavior of binary V–Ti and ternary V–Ti–Nb alloys in the temperature range above 650°C. The results show the prominent influence of the titanium on the creep rupture and creep behavior of the alloys. For titanium contents above about 1% the creep rupture strength drops for rising titanium concentrations, while the short-time high-temperature strength rises, regardless of the niobium content. For increasing niobium contents the holding time is increased, but the influence of the niobium drops for rising holding times, so that the $\sigma_{s/10.000}$ values depend to a small degree on the niobium content. The best vanadium alloys show long-time strength values which can barely be reached by any other materials. A marked dependence on the titanium content is also displayed by the creep activation energy in the temperature range around 650°C, while the niobium content has no influence upon this quantity. The studies indicate that the creep rupture and creep behavior of the alloys are also determined by the interactions between titanium and the interstitial impurities at high titanium contents. Author (NSA)

N69-19218# Japan Atomic Energy Research Inst., Tokyo.

ON THE POLYMORPHIC TRANSFORMATION OF ZIRCONIUM DIOXIDE ASSOCIATED WITH THE BREAKAWAY DURING HIGH TEMPERATURE OXIDATION OF Zr AND SOME Zr ALLOYS

Tadayuki Nakayama et al Sep. 1968 16 p refs Transl. into ENGLISH from Nippon Kinzoku Gakkaishi (Sendai City, Japan), no. 31, Jul. 1967 p 839–845
(NSJ-TR-138) Avail: CFSTI

The breakaway phenomena of Zr and some Zr alloys during high temperature oxidation were studied from a structural point of view, by means of high temperature X-ray diffraction, thermal gravimetry, optical microscopy, and differential thermal analysis. The structural change in oxide scale at breakaway is in close relation with the polymorphic transformation of zirconium dioxide (tetragonal ⇄ monoclinic). The continuous observation of change in oxide scales with high temperature X-ray diffraction clarified that black colored pre-breakaway oxide layers contained a considerable quantity of metastable tetragonal oxide, and that the color of oxide layers from black to white and the polymorphic transformation to monoclinic oxide occurred simultaneously at breakaway. The contents of tetragonal modification in prebreakaway oxide scales on Zr alloys containing Ti or Sn were larger than that on pure Zr, and this agrees reasonably with the facts that the breakaway occurs at lower temperatures on those alloys, and that those elements lower the transformation temperature of zirconium dioxide. In the stable region of the tetragonal form, the breakaway did not occur in O_2. Author (NSA)

N69-19340# Bureau of Mines, Rolla, Mo.

EFFECT OF VARIED EXTRUSION TEMPERATURE ON THE PROPERTIES OF A ZINC-COPPER-TITANIUM ALLOY

L. A. Neumeier and J. S. Riebeck Feb. 1969 26 p refs
(BM-RI-7229) Avail: Issuing Activity

The properties of a Zn-0.75 % Cu-0.12 % Ti alloy extruded at temperatures between 400° and 720°F were evaluated. The extrusions were made with a reduction ratio of 28 to 1 and at relatively slow speed. The rod was also extruded at 580° and 640°F with a reduction of 258 to 1. With increased extrusion temperature, extrusion pressure decreased substantially, and creep resistance of

the rod improved significantly. Coefficients of thermal expansion were low in the long rod dimension. Microstructures, hardness, and tensile properties were also evaluated, and a limited evaluation was made of bend ductility at 32° F for the rod extruded with the 255 to 1 reduction. Author

N69-19311# Michigan State Univ., East Lansing.
TRANSPORT AND DEFECT PROPERTIES OF THIN METALLIC WIRES Progress Report
Jack Bass 16 Sep. 1968 10 p refs
(Contract AT(11-1)-1247)
(COO-1247-12; PR-8) Avail: CFSTI

The following topics were studied: (1) Size-dependent deviations from Mattiessen's rule in aluminum; (2) electric conductivity of platinum and molybdenum wires quenched in liquids; and (3) electric conductivity of tungsten wires quenched in superfluid helium. NSA

N69-19313# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.
THE OXIDE TOPOGRAPHY ON CRYSTAL-BAR AND REACTOR GRADE SPONGE ZIRCONIUM
B. Cox and A. R. McIntosh Nov. 1968 31 p refs
(AECL-3223) Avail: Atomic Energy of Can., Ltd., Chalk River: $1.00

A study of the surface topography of oxide films formed on unalloyed zirconium in steam or water at 300°C has revealed no processes which might lead to the formation of protruding oxide needles or platelets. All features having the appearance of needles or platelets when seen in profile could have been produced by oxide cracking and loss of adherence at the interface leading to curling of the oxide. The incidence of oxide cracking is determined by the conditions under which oxidation is carried out. Specimens oxidized at high pressure in water showed a tendency for the oxide to crack and peel when less than 2000Å thick which leads to the platelet like features. During oxidation at low pressure the sites of rapid oxidation lead to patches and ridges of thick oxide which crack along lines of maximum stress; there is little tendency for the oxide to peel when formed at low pressure until a late stage in the oxidation. Author

N69-19323# California Univ., Berkeley. Lawrence Radiation Lab.
EXPERIMENTAL CORRELATIONS FOR HIGH-TEMPERATURE CREEP
Amiya K. Mukherjee, James E. Bird, and John E. Dorn Oct. 1968 84 p refs Presented at the Mater. Eng. Congr. of the Am. Soc. for Metals, Detroit, 15 Oct. 1968
(Contract W-7405-ENG-48)
(UCRL-18526; CONF-681018-2) Avail: CFSTI

The present status of experimental knowledge of the high-temperature creep of some metals and alloys is evaluated with particular reference to the significance of climb of dislocations. The effects of the independent variables of stress and temperature on the creep rate and the possible influence of crystal structure, modulus of elasticity, stacking-fault energy, and grain size on these data are discussed. The major substructural changes that accompany high-temperature creep are reviewed. A summary is presented on the theoretical implications of the known experimental facts relative to the validity of various proposed high-temperature creep mechanisms. NSA

N69-19331# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
EXTRUSION AND HOT ROLLING—TWO ADVANCED FABRICATION TECHNIQUES FOR THE PREPARATION OF WHISKER-METAL COMPOSITES
W. Wolkowitz and T. S. Stanislaw Jan. 1969 20 p refs Presented at the 14th Natl. SAMPE Symp., Cocoa Beach, Fla., 5-7 Nov. 1968
(RM-437J) Avail: CFSTI

The experimental work on metal-matrix composites described has focused on silicon carbide and aluminum oxide whiskers in copper and aluminum alloy matrices. Its main objective has been to determine the feasibility of producing reinforced sheet material by fabrication methods that have good scale-up potential—extrusion and hot rolling. Since successful orientation of the whiskers could not be achieved by hot rolling, the investigation concentrated on the extrusion of a putty-like mixture of metal powder, whiskers, and plasticizer. This proved to be an effective method for producing a well distributed, oriented preform, suitable for further processing. The extrusion process is described in detail, as is the research into ways to consolidate the preforms into sheet material while preserving the whisker orientation and minimizing fracture. Author

N69-19333 National Lending Library for Science and Technology, Boston Spa (England).
THE INFLUENCE OF CHEMICAL COMPOSITION ON THE MECHANICAL PROPERTIES OF GREY CAST IRON
Wolfram Weis et al [1968] 30 p refs Transl. into ENGLISH from German conf. paper In ENGLISH and GERMAN Presented at the 34th Intern. Foundry Congr., Paris, Oct. 1967
(NLL-EE-Trans-1834-(3774.5)) Avail: Natl. Lending Library, Boston Spa, Engl.

The general validity of the statistically determined correlations between the chemical composition and mechanical properties of unalloyed gray cast iron is considerably limited, partly because the formulas are based on inadequate model concepts, and partly because the evaluations are based only on small, non-representative groups of values. By statistical evaluation of 630 industrial samples it is shown that, with cast bars of 30 mm diameter, the tensile strength, (σ_B), the Brinell hardness (HB), and the initial modulus of elasticity (E_o) can be predicted from the carbon, silicon, manganese, phosphorus and sulfur contents, with the following standard deviations: $\sigma_B : S_R = \pm 2.48$ kg/mm^2; HB : $S_R = \pm 12.02$ kg/mm^2; and $E_o : S_R = \pm 587.5$ kg/mm^2. Investigation of the samples showing extreme deviation from the correlations has shown that the tensile strength is higher than calculated if, for example, chromium, molybdenum, or nickel are present in amounts > 0.2%, or if a pronounced primary austenite dendritic structure is observed. Author

N69-19345# Bureau of Mines, Washington, D. C.
DISPERSION-STRENGTHENED COPPER: ITS PREPARATION AND PROPERTIES
D. H. Desy Mar. 1969 28 p refs
(BM-RI-7228) Avail: Issuing Activity

The properties of copper that had been oxide dispersion-strengthened with 2 vol pct of either yttria or alumina were studied. Compounds of copper and aluminum or yttrium, coprecipitated from aqueous solution, were converted to oxides; the copper was reduced, compacted, sintered, and extruded. For the resulting copper-dispersoid composites, room temperature tensile properties after annealing in hydrogen, elevated temperature tensile and stress-rupture properties, and electrical conductivity were determined. Compared with oxygen-free copper, copper-2 vol pct alumina or yttria had improved strength after annealing between 400° and 1,000°C, and improved elevated temperature strength, with little loss in electrical conductivity. Author

N69-19374 Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
DIMENSIONAL ULTRASONIC MEASUREMENTS FOR CORROSION CONTROL IN INCONEL TUBES INSTALLED IN CHEMICAL PLANT [CONTROLE DIMENSIONAL E CONTROLE DA CORROSAO DE TUBULACAO EM INDUSTRIA QUIMICA]
C. Mendonca Filho, H. Omuric, W. P. Monteiro, and M. F. Barbosa [1968] 31 p refs In PORTUGUESE; ENGLISH summary (Rept-681007; Rept-6810-344) Avail: CFSTI

The report describes the tube position, adopted procedure, equipment and accessories, selected points and the result of the ultrasonic thickness measurements for the corrosion control of inconel tubes installed in a chemical plant. The results are presented in numerical form indicating in drawings the points measured, including photographs of the observed echograms. Author

N69-19414# National Lead Co. of Ohio, Cincinnati. Feed Materials Production Center.
[TECHNICAL DIVISION] Summary Technical Report, 1 Jul.–30 Sep. 1968
R. Burgett, ed. Nov. 1968 31 p refs
(Contract AT(30-1)-1156)
(NLCO-1025) Avail: CFSTI

Research progress is reported on: colorimetric determination of microgram concentrations of Zr in thorium materials, reduction of machining stock on Mark VR extruded tubing, annealing of a heavily worked uranium-base alloy, high-temperature drop hammer and hardness tests of cast uranium-base dilute quinary alloys, microhardness of a uranium-base alloy compared with high-purity uranium, and continuous determination of NO_2 in plant gas streams. NSA

N69-19419# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
INFLUENCE OF TRANSFORMATION OF OXIDE ON THE PROPERTIES OF COMPOSITE Al-Al_2O_3 MATERIALS [INFLUENZA DI TRANSFORMAZIONI DELL'OSSIDO SULLE PROPRIETA' DEI MATERIALI COMPOSITI Al-Al_2O_3]
G. Beghi Oct. 1968 27 p refs In ITALIAN; ENGLISH summary (EUR-4185.I) Avail: CFSTI

Al_2O_3 was heat treated in the liquid phase at high temperature and for short times. Two influences on the oxide observed were a partial transformation to coarse alpha phase particles, and spheroidizing and coalescence of the particles still having the gamma alumina structure. The transformation was quantitatively evaluated by X-ray diffraction as a percentage of oxide transformed to the alpha phase. Mechanical properties were determined at 20° and 450°C. The values reported as a function of the percentage of transformation show a decrease in strength and an increase in ductility. The variation in the mechanical properties is related to the oxide changes. Author

N69-19449# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Material- und Festkoerperforschung.
INVESTIGATION OF THE MODIFICATION OF THE OCCURRENCE OF BRITTLE PHASES IN WELDED JOINTS BETWEEN DIFFERENT TYPES OF MATERIAL WELDED BY THE ELECTRON BEAM PROCEDURE [UNTERSUCHUNGEN UEBER DIE BEEINFLUSSUNG DES AUFTRETENS SPROEDER PHASEN AN SCHWEISSVERBINDUNGEN ZWISCHEN VERSCHIEDENARTIGEN WERKSTOFFEN NACH DEM ELEKTRONENSTRAHLSCHWEISSVERFAHREN]
W. Scheibe Jul. 1968 111 p refs In GERMAN
(KFK-736) Avail: CFSTI

Electron beam butt welding on 0.5 mm thick sheets of the material combination CrNi 18 8–Inconel 600 has shown that it is possible to obtain practically any concentration pattern in the molten zone and large concentration jumps on the boundaries of the molten zone. The size of the concentration jump depends on the site of the collision point of the electron beam with respect to the butt joint. It is possible to so affect the mixing and conditions in the weld seam that congruently melting intermetallic phases are limited to a narrow region of the weld seam and incongruently melting intermetallic phases are completely suppressed. On a number of material combinations, which could not previously be welded flawlessly because of the occurrence of these phases, bend angles over 180° could be obtained. On the few combinations whose bend angles $< 180°$, bend angles $> 180°$ could be obtained in all cases by a 0.3-mm thick intermediate layer of V. Studies on the mixing ratio of material combinations up to 10 mm show that at this thickness a favorable concentration pattern of intermetallic phases can be produced. Author (NSA)

N69-19517 National Lending Library for Science and Technology, Boston Spa (England).
A STUDY OF THE PHENOMENA OBSERVED IN THE CUTTING OXYGEN JET AS USED FOR FLAME CUTTING [UNTERSUCHUNG DER VORGAENGE BEIM BREMNSCHMEIDEN IM SCHNEIDSAUERSTOFFSTRAHL]
Manfred Beckert Nov. 1968 16 p refs Transl. into ENGLISH from Schweisstechnik (Berlin), v. 18, no. 1, Jan. 1968 p 12–16
(NLL-M-7501-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

Experiments were conducted to determine the effects of O_2 purity and O_2 velocity on the oxygen cutting jet. In particular, the effects of the form and shape of the heating flame on the cutting properties of the jet at large distances from the nozzle orifice were examined. These were found to be important factors in heavy flame cutting. Flame cutting experiments were also conducted to verify data on the role and most favorable condition of the transition zone between the oxygen jet and the heating flame, and its effect on the shape and depth of the kerf. In addition, temperatures in the cross section of the cutting jet were measured, and the influence determined of the presence of a kerf, the type of nozzle, and the oxygen pressure. It is concluded that the cutting properties can be controlled by adjusting the heating flame and the oxygen jet, and that cutting performance can be increased by up to 40% to meet the demands of industry and to lower cutting costs in separating the thicker materials. M.G.J.

N69-19552# Du Pont de Nemours (E. I.) and Co., Wilmington, Del. Engineering Materials Lab.
MICROSTRUCTURE AND CORROSION RESISTANCE OF AUSTENITIC STAINLESS STEELS
Donald Warren Sep. 1968 106 p refs Presented at the 6th Ann. Liberty Bell Corrosion Course, Philadelphia, Sep. 1968; sponsored by NACE, Philadelphia and Drexel Inst. of Tech.
Avail: Issuing Activity

The microconstituents of austenitic stainless steels can significantly affect their corrosion resistance. The presence of phases such as ferrite, carbides, intermetallic compounds, and nonmetallic inclusions is contingent upon alloy composition and metallurgical processing. Whether or not these phases are deleterious depends upon their morphology and the nature of the chemical environment. This paper illustrates the influence of second phases upon the resistance of austenitic stainless steels to intergranular attack, stress-corrosion cracking, and pitting corrosion. Author

N69-19557 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECT OF THE DIFFUSION ANNEALING ON THE STRUCTURE OF HIGH SPEED STEELS [WIRKUNG EINER DIFFUSIONSGLUEHUNG AUF DAS GEFUEGE VON SCHNELLARBEITSSTAHL]

Ernst Kunze et al 21 Nov. 1968 23 p ref in ENGLISH and GERMAN Transl. into ENGLISH from DEW Tech. Ber. (Krefeld), v. 4, no. 2, 1964 p 63–67
(NLL-EE-Trans-1760-(3774.5)) Avail: Natl. Lending Library, Boston Spa, Engl.

The primary structure of ledeburitic steels showed considerable irregularities in the distribution of the alloying elements. Tests were carried out with the two high...t alloyed and carburized high speed steel grades Komo 310 and SA 900 regarding the effect of a solution treatment on a more regular structure. After long annealing periods of up to 50 hours and temperatures near 1180°C, the structure of the hardened and tempered steel showed an essentially more regular distribution of the residual austenite. An estimation of the diffusion speeds of the individual alloying elements and a comparison of the latter, make it probable that the sole cause for the improvement of the structure is the migration of the carbon atoms. Author

N69-19561*# Stanford Research Inst., Menlo Park, Calif.
EFFECT OF ENVIRONMENT ON THERMAL CONTROL COATINGS
S. R. Morrison, T. Freund, and K. Sancier 3 Dec. 1968 62 p refs Prepared for JPL
(Contract NAS7-100; JPL-951522)
(NASA-CR-100210; IR-2) Avail: CFSTI CSCL 11C

Degradation of thermal control coatings under combined conditions of ultraviolet radiation and vacuum is initiated by the photoproduced holes and electrons and their chemical reactions leading to coloration. Surface additives can act as recombination centers and prevent optical degradation. Tests with ferricyanide additives on a single ZnO crystal reduced the degradation rate by six orders of magnitude or more in some cases. Preliminary results of reduced optical degradation in additive treated powders are also reported. G.G.

N69-19585 National Lending Library for Science and Technology, Boston Spa (England).
ON THE LOW TEMPERATURE NOTCH DUCTILITY OF VARIOUS LOW HYDROGEN WELD METALS
Alexis Neumann et al [1968] 18 p refs Transl. into ENGLISH from Schweisstechnik (Berlin), v. 18, no. 9, 1968 p 385–390
(NLL-M-7470-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

The results of some 4000 notch ductility tests on low hydrogen welds were analyzed by methods of mathematical statistics. For a plate welded with the same electrodes there is no significant difference in the spread of results across the weld at any point. Between about +20 and −60°C the scatter is bimodal and impact strength values lie in good approximation to Gaussian distributions shared between high and low value collective groups. Thus the notch ductility v. temperature curve consists of an upper curve branch evidencing semi-ductile fracture with characteristic plastic deformation at the notch root and a lower curve branch evidencing brittle fracture with characteristic tearing opposite the notch. Bimodality is a basic phenomenon and is not eliminated through notch shape or position, or by normalizing the weld. Notch ductility adjacent to the weld also shows bimodal scatter. Author

N69-19598# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
CORROSION AND HYDRIDING RESPONSE AND OXIDE PROPERTIES OF SIX IRRADIATED ZIRCONIUM ALLOYS
A. B. Johnson, Jr. Sep. 1968 46 p refs Presented at the Appl.-Related Phenomenon of Zirconium and Hafnium Symp., Philadelphia, Pa.
(Contract AT(45-1)-1830)
(BNWL-SA-1719-Rev; CONF-681105-1) Avail: CFSTI

A series of in-reactor corrosion tests were conducted in the ETR in pH-10 NH_4OH at 270 to 280°C. Six Zr alloys were exposed in as-etched and prefilmed (400°C steam) surface conditions. The six alloys were Zircaloy-2, Zircaloy-4, Zr–3Nb–1Sn, Zr–2.5Nb, Zr–1.2Cu–0.28Fe and Zr–1.2Cr–0.08Fe. Exposures were 25, 37, 77, and 174 days in high-flux, low-flux, out-of-flux and out-of-reactor environments. Results from the 174-day exposure are emphasized, but corrosion and hydriding data from the complete test series are compared. A marked uptake in rate between the 77-day and 174-day exposures is attributed to an increase in O level near the end of the deoxygenating resin life. Author (NSA)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N69-18664*# Southern Research Inst., Birmingham, Ala.
AN INVESTIGATION OF SOME THERMAL AND MECHANICAL PROPERTIES OF A LOW-DENSITY PHENOLIC-NYLON ABLATION MATERIAL Final Report
H. G. Sander, E. D. Smyly, and C. D. Pears Feb. 1969 459 p refs
(Contract NAS1-5448)
(NASA-CR-66731) Avail: CFSTI CSCL 11D

The thermal and mechanical properties of low-density phenolic-nylon were studied. Investigations of the tensile and compressive properties of the nondegraded material to isolate the effects of variations in experimental techniques, test conditions and environmental parameters from the intrinsic properties are presented. Characterization of the charred material, definition of its thermal conductivity and the development of an analysis so that the data could be extrapolated to conditions other than those under which the measurements were made are included. Author

N69-18741*# Avco Corp., Wilmington, Mass. Space System Div.
THE POST-TEST ANALYSIS OF ABLATIVE MATERIALS Final Report, 11 Jul. 1967–15 May 1968
B. W. Burrell, D. P. Crowley, M. A. De Sesa, and M. E. Ihnat 10 Feb. 1969 263 p refs
(Contract NAS3-10300)
(NASA-CR-72400; AVSSD-0090-69-RR) Avail: CFSTI CSCL 11D

Silica and graphite–phenolic ablative materials were examined before and after test firing in a rocket engine nozzle. Chemical, thermal, and physical characterizations of the post-fired nozzle chars were performed in depth at selected nozzle locations. Similar characterizations were also performed on raw billets and laboratory oven-prepared chars. The fired nozzle char property determinations were performed on various layers removed from the char zones and included carbon, hydrogen, oxygen, and ash analysis, trace metal analyses, density, porosity, X-ray diffraction analysis, optical reflectance, photomicrographic analysis, specific heat, and thermal conductivity. Data are presented in tabular and graphical property profile format. Author

N69-18804# Triplex Safety Glass Co., Ltd., London (England).
THE EFFECT OF STORAGE ON THE STRENGTH OF ANNEALED AND TOUGHENED CLEAR WHITE PLATE GLASS
Min. of Technol. Sep. 1968 34 p Supersedes D-Mat/S-107
(Contract 6/Stores/29838-C/CB-41A)
(D-Mat-153) Avail: CFSTI

The effect of storage on the strength of annealed and toughened clear white plate glass has been investigated using storage in atmospheric conditions, compared with storage in dry, carbon dioxide-free conditions over a five year period. The work on toughened glass was conducted on 450 pieces of 3/16 in. clear white plate glass and consistent process conditions were used throughout. A similar number of tests were made on annealed glass specimens of the same size. Test batches were chosen at random for each of the conditions studied. Under all conditions a reduction in strength took place over an initial period up to 18 months. Thereafter, a considerable recovery took place. It is estimated that total recovery would take place in about eight years. The exposed toughened glasses showed a maximum reduction to 90% of the original value, the annealed specimens showing a greater percentage reduction as ageing in primarily an intrinsic property of the glass surface. The difference between the exposed specimens and those stored under dry carbon dioxide-free conditions for both an nealed and toughened glasses was shown to be significant at the 2% level of probability. Author (ESRO)

N69-19138*# Kulite Semi-Conductor Products, Inc., Ridgefield, N. J.
THE DEVELOPMENT AND EVALUATION OF AN INORGANIC BONDING METHOD FOR SEMICONDUCTOR STRAIN GAGES FOR SPACE AND ULTRA HIGH VACUUM APPLICATIONS Final Project Report, 7 Jun.–7 Dec. 1968
7 Dec. 1968 85 p (Contract NAS5-11558)
(NASA-CR-100015) Avail: CFSTI CSCL 11A

A description of the development and evaluation of an inorganic bonding method for semiconductor strain gages for use in space and ultra high vacuum applications is presented. Included are a discussion and the experimental results of the two basic methods for inorganically bonding a semiconductor strain gage to a metallic substrate. One method is to use an inorganic material such as glass as the bonding material; the other is to form a metallic bond between the strain gage and the substrate. Conventional organic epoxy adhesives outgas when exposed to ultra high vacuum, and as operating temperatures are increased they begin to exhibit plastic behavior causing hysteresis and zero instability in the transducer. The use of an inorganic glass as the bonding material has resulted in a significant advance in transducer fabrication technology. Author

N69-19202*# General Electric Co., Philadelphia, Pa. Missiles and Space Div.
PRELIMINARY INVESTIGATION OF FEASIBILITY OF WEAVING TRIAXIAL FABRICS Final Report
Norris F. Dow Jan. 1969 54 p refs
(Contract NAS9-8026)
(NASA-CR-99534) Avail: CFSTI CSCL 11E

Studies were carried out to determine the feasibility of weaving triaxial fabrics (Doweave), in tight, low porosity configurations, and to investigate the stability and isotropy of triaxially woven fabrics. Detailed analyses of yarn motions required in triaxial weaving cycles disclosed no fundamental problems to prevent the achievement of tight fabrics woven of fine yarns. A breadboard loom, assembled to produce samples, to a degree confirmed analytic predictions of loom configuration precision required to yield quality triaxial fabrics. Guidelines were generated for extending weaving capabilities for full-scale production. Author

N69-19275# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
GLASS SUBMERSIBLE RECOMMENDATIONS
H. D. Kivlighn, Jr. Jan. 1969 17 p refs
(RM-436) Avail: Issuing Activity

The best use of glass in a deep-ocean environment is reported. Glasses available on the market are investigated, with the conclusion that a composition from the soda-lime field would provide the most immediately applicable material. A second approach is offered for the development of better glasses from glass-ceramic compositions. An important advantage of the vitreous state of a glass-ceramic is the incorporation of built-in quality control relative to the production of thick walled structures. The potential use of ion exchange as a strengthening process is examined, with particular emphasis upon uncrystallized glass-ceramic materials. Author

N69-19276*# Army Natick Labs., Mass.
POLYMER STRUCTURE AND MECHANICAL PROPERTIES
Apr. 1967 451 p refs Proc. of Conf. held at Natick, Mass., 19–21 Apr. 1967
(NASA Order R-22-015-006)
(NASA-CR-100141) Avail: CFSTI CSCL 07D

The conference papers presented pretained to the mechanical properties of rubbery polymers, the morphology of crystalline polymers, mechanical properties of crystalline polymers, polymer transition and relaxation processes, and viscoelastic transition. For individual titles, see N69-19277 through N69-19296.

N69-19277*# Akron Univ., Ohio. Inst. of Polymer Science.
DEFORMATION AND FRACTURE OF ELASTOMERS
A. N. Gent *In* Army Natick Labs. Polymer Struct. and Mech. Properties Apr. 1967 p 4–28 refs Supported in part by NSF (See N69-19276 08-18)
Avail: CFSTI CSCL 11J

Part of the energy expended in deforming elastomers is dissipated in overcoming the viscous resistance to motion of the molecular chains and in breaking structures associated with fillers or crystalline regions. These energy losses have recently been shown to govern a wide variety of mechanical properties: tensile strength, tear resistance, resistance to surface cracking by ozone, sliding friction and abrasion. A review is given of these findings. In addition, attention is drawn to modes of failure which might be properly termed elastic instabilities, as they can be predicted quantitatively from the elastic properties alone. Author

N69-19278*# Natural Rubber Producers Research Association, Welwyn Garden City (England).
RELATIONSHIP BETWEEN CROSSLINK TYPE AND MECHANICAL PROPERTIES
Leonard Mullins *In* Army Natick Labs. Polymer Struct. and Mech. Properties Apr. 1967 p 29–47 refs (See N69-19276 08-18)
Avail: CFSTI CSCL 11J

If rubber is vulcanized to the same extent by different vulcanizing systems, the resultant vulcanizates may have widely differing strength properties; tensile strength, fatigue strength, cut growth resistance, tear resistance, and wear resistance. These differences in strength must stem from: (1) differences in the actual crosslink; (2) chemical modification of the main chain during vulcanization; and (3) changes in the effective initial molecular weight of the base polymer. Techniques were developed to provide information about the detailed vulcanizate structure—the nature of crosslinks. Tracing the effect of sulfur crosslink type on the physical properties is reviewed, and vulcanizing systems to give required crosslinking types are selected. The progressive change in crosslink type which occurs with prolonged vulcanization and the effect on the mechanical properties of these vulcanizates are recorded. B.P.

N69-19279*# Dow Chemical Co., Midland, Mich.
EQUATIONS OF STATE FOR ELASTOMERS
Turner Alfrey, Jr. *In* Army Natick Labs. Polymer Struct. and Mech. Properties Apr. 1967 p 48–60 (See N69-19276 08-18)
Avail: CFSTI CSCL 11J

A method is presented of representing arbitrarily large multiaxial strains in incompressible elastomers using points on a triangular coordinate system. An assumption is made that the strain energy is a smooth function of the strain; this leads to a strain energy function of the form employed by Landel for moderate method is developed by considering a hysteresis free incompressible elastomer deformed in three mutually perpendicular directions to arbitrary extension ratios. The restrictions on the strain energy density are examined; these are deduced from the minimal assumptions of smoothness and symmetry, which involved polar coordinate expansion of a smooth function. The equation of state is formulated for elastic materials, for arbitrarily large strains, and for an arbitrary multiaxial character of the stress and strain. B.P.

N69-19280*# Stevens Inst. of Tech., Hoboken, N. J. Dept. of Chemistry and Chemical Engineering.
PLASTIC YIELD BEHAVIOR OF GLASSY POLYMERS
Rodney D. Andrews, Jr. *In* Army Natick Labs. Polymer Struct. and Mech. Properties Apr. 1967 p 61–76 refs (See N69-19276 08-18)
Avail: CFSTI CSCL 11I

The results of stress–strain and creep tests on polystyrene and polymethyl methacrylate are analyzed for the yield behavior of these glassy polymers. The stress–strain results suggested that the yield phenomenon cannot be regarded as a flow process in the normal sense, since viscoelastic flow of a polymer is known to depend on the 3.4 power of molecular weight, and no such relation is evident. Creep measurements were made as a function of temperature and stress level. One of the major results of this investigation was that drawing was found to take place only on a limited region of stress and temperature. Time effects, associated with the yield and drawing process, were studied by means of interrupted drawing experiments. The effect of the length of the interruption period was examined and it was found that the yield peak gradually builds up as a function of time in the interruption by stress relaxation. B.P.

N69-19281*# Imperial Chemical Industries Ltd., Welwyn Garden City (England). Plastics Div.
A WORKING HYPOTHESIS OF POLYMER FRACTURE
P. I. Vincent *In* Army Natick Labs. Polymer Struct. and Mech. Properties Apr. 1967 p 77–90 refs (See N69-19276 08-18)
Avail: CFSTI CSCL 11I

It is proposed that many observed trends in the probability of fracture of polymers can be understood if the fracture process is treated as an instability in deformation. A table summarizes the effects of many variables and, in order to explain the approach, a few examples are treated in greater detail: (1) the inverse relation between maximum attained impact strength and tensile yield stress; (2) cracking of low molecular weight samples during solidification; (3) reduction in the rate of orientation hardening at high temperatures; (4) localized temperature rises during high speed deformation; (5) differences in behaviour in tension, flexure and compression; and (6) the effects on the true stress-strain curve of changes in plasticizer concentration, molecular weight, and pre-orientation. It is concluded that the mechanism of polymer fracture is a competition between localized hardening by molecular orientation and localized softening. The softening is partly of the normal type which leads to yielding and partly caused by a rise in temperature in adiabatic deformation at high straining rates. Author

N69-19290*# Kyushu Univ., Fukuoka (Japan). Faculty of Engineering.
MECHANICAL PROPERTIES OF POLYMER SINGLE CRYSTALS AND EXTENDED CHAIN CRYSTALS—DISCUSSION OF DEFECT REGION AND LOOSE CHAINS ATTACHED TO THEM
Motowo Takayanagi *In* Army Natick Labs. Polymer Struct. and Mech. Properties Apr. 1967 p 284–293 ref (See N69-19276 08-18)
Avail: CFSTI CSCL 20B

Crystalline absorption of polyethylene single crystals is affected by a geometrical factor (long period L) and a defect region apart from the chemical structure. Single crystals with different long period L prepared by regulating isothermal crystallization conditions, (A) and annealed single crystals with different L (B) were compared in their behavior in the crystalline absorption regions. The absorption temperatures of both samples are expressed by a one valued function of L, as in the melting temperature. The absorption magnitude of sample A increases with increasing L, while that of sample B decreases with increasing L. This difference was attributed to the effect of introduction of defect regions into B lamellae by annealing. B.P.

N69-19291*# Massachusetts Univ., Amherst
HIGH SHEAR FLOW OF PARTIALLY CRYSTALLINE POLYMERS
Roger Porter *In* Army Natick Labs. Polymer Struct. and Mech. Properties Apr. 1967 p 294–298 refs (See N69-19276 08-18)
Avail: CFSTI CSCL 20B

Experimental data are presented on steady flow viscosity measurements of polyethylene made under pressure in steel capillaries using an Instron Tester. The three low density polyethylenes tested differed principally in molecular weight which was in the range from 2,800 to 10,000. The measurements on the systems, at temperatures above their crystalline melting points, indicated that the flow properties are entirely Newtonian. There are no indications of thixotropy or shear heating effects with the measurements being entirely reproducible within the test series proceeding from high to low and low to high rate of shear. B.P.

N69-19292*# Dow Chemical Co., Midland, Mich. Plastics Dept.
MULTIPLE TRANSITIONS AND RELAXATIONS OF POLYMERS IN RELATION TO MECHANICAL PROPERTIES
Raymond F. Boyer *In* Army Natick Labs. Polymer Struct. and Mech. Properties Apr. 1967 p 299–379 refs (See N69-19276 08-18)
Avail: CFSTI CSCL 11I

An overview is presented on the multiple transitions and relaxations for polycarbonate, polytetrafluorethylene, polyethylene, polyvinylchloride, polymethylmethacrylate, polyphenylene oxide, polycyclohexylmethacrylate, and polystyrene. Data and interpretative results are briefly reviewed for each of the polymers. Some of the physical properties which were noted to have changed at secondary transitions were: modulus of elasticity, coefficient of thermal expansion, impact strength, tensile strength, toughness, creep rate, heat content, rheological properties, coefficient of friction, dielectric loss, tackiness temperature, solubility, and diffusion of solvents. It was assumed that dynamic mechanical spectroscopy at about 1 cps was the tool which indicated the existence of a secondary loss mechanism, while dielectric loss and NMR were auxiliary tools to aid in understanding the phenomenon. The effect of secondary loss peaks on room temperature impact was tabulated for the polymers. B.P.

N69-19294*# Massachusetts Univ., Amherst.
PROPERTIES OF ETHYLENE–METHACRYLIC ACID COPOLYMERS AND THEIR SODIUM SALTS: MECHANICAL RELAXATIONS
William J. Mac Knight, L. W. Mc Kenna, and B. E. Read *In* Army Natick Labs. Polymer Struct. and Mech. Properties Apr. 1967 p 410–429 refs (See N69-19276 08-18)
Avail: CFSTI CSCL 11I

A study was made of the mechanical relaxation behavior of an ethylene–methacrylic acid copolymer containing 4.1 mole

percent acid units and its partially ionized sodium salts. Degrees of ionization, estimated from infrared analysis, ranged from 0% to 78%. The weight percent crystallinity of the samples, determined by differantal scanning calorimetry, varied from about 15 for the acid copolymer to about 7 for the 78% ionized copolymer. Four relaxation regions were observed. They are labelled α, β', β and γ and each have been assigned to motions within the amorphous phase of the polymer. In plots of the logarithmic decrement against temperature (at 1 c/s), the α peak for the annealed acid copolymer occurs at 50°C and shifts to higher temperatures with increasing degree of ionization. The β' peak occurs at 23°C for the annealed acid copolymer and decreases in magnitude with increasing ionization. The β peak is absent for the acid copolymer but appears at 10°C for the ionized polymers and increases in height with increasing ionization. The onset of the γ peak is observed at −120°C and is associated with the local motions of linear methylene sequences. Author

N69-19295*# London Univ. (England). Queen Mary Coll.
STUDIES IN THE FIELD OF POLYMER STRUCTURE AND MECHANICAL PROPERTIES IN THE MATERIALS SCIENCE DEPARTMENT, QUEEN MARY COLLEGE, E.1, ENGLAND
E. H. Andrews *In* Army Natick Labs. Polymer Struct. and Mech. Properties Apr. 1967 p 430–436 refs (See N69-19276 08-18)
Avail: CFSTI CSCL 11J

A summary review of research projects in polymer structure is presented. Electron microscope studies were made of ultrathin cast films of natural rubber which were crystallized at predetermined strains and at temperatures between −40° and 10°C. The relationship between strength and stress–strain data on crystallized natural rubber was studied. A freezing ultramicrotome was developed which allowed ultrathin sections to be cut from soft polymers and rubbers for examination in the electron microscope. Such features as ringed spherulites in annealed low density polyethylene are revealed in considerable detail and may be studied before and after plastic deformation with the aid of the microtome. The macroscopic fracture mechanics of polyethylene are discussed. The propagation of a single corrosion crack in stressed plastics wes studied with a view to establishing the basic mechanism of environmental stress cracking. B.P.

N69-19296*# Mellon Inst., Pittsburgh, Pa.
COMMENTS ON VISCOELASTIC TRANSITIONS AND THE PROPOSED LIQUID-LIQUID TRANSITION IN POLYSTYRENE
Donald J. Plazek *In* Army Natick Labs. Polymer Struct. and Mech. Properties Apr. 1967 p 437–446 (See N69-19276 08-18 refs
Avail: CFSTI

A previously advanced argument for the existence of a liquid-liquid transition in polystyrene is critically examined. This previous argument states in principle that any proposed transition which is based on a change from segmental to cooperative action of entire polymer chains must show up in melt viscosity data. Since all of the polymers examined in a recent review article on the viscous flow of polymers could be fitted to a free volume equation or any equivalent form, no evidence for transition can be claimed as showing up in the melt viscosity. In the present paper, this is specifically demonstrated for polystyrene with data obtained on five samples. Reasons are presented according to which viscoelastic dispersions, which are functions of time or frequency, usually should not be directly associated with thermodynamic transitions. It is suggested that caution be exercised in inferring thermodynamic changes in a material from the presence of wrinkles or bends in viscoelastic or volume functions of temperature. K.W.

N69-19365# Oak Ridge National Lab., Tenn.
MECHANICAL PROPERTIES OF ARTIFICIAL GRAPHITES—A SURVEY REPORT
W. L. Greenstreet Dec. 1968 49 p refs
(Contract W-7405-ENG-26)
(ORNL-4327) Avail: CFSTI

A review of published mechanical properties data for artificial graphites is given; high-temperature as well as room-temperature data are included. The intent is to provide a unified description of the complex mechanical behavior associated with these materials. A brief history on graphite and discussions of crystalline structure and of manufacturing methods are included. Author (NSA)

N69-19537 National Lending Library for Science and Technology, Boston Spa (England).
MODIFICATION OF THE SURFACE PROPERTIES OF SYNTHETIC FIBRES BY GAS-PHASE GRAFT POLYMERIZATION [MODIFITSIROVANIE POVERKHNOSTNYKH SVOISTV SINTETICHESKIKH VOLOKON METODOM GAZOFAZNOI PRIVITOI POLIMERIZATSEE]
A. I. Kuritenko et al Dec. 1968 7 p refs Transl. into ENGLISH from Russian
(NLL-RTS-4903) Avail: Natl. Lending Library, Boston Spa, Engl.: 12s 6d

This paper presents the results of studying how the grafting of different vinyl monomers (vinyl acetate, pentadiene, maleic anhydride, 4-chloroethylene, 3-chloroethylene, 1-hexene, 3-heptene) affects the adhesion and wettability of synthetic fibers. The experiments were performed with commercial highly-oriented polypropylene, Lavsan and Kapron fibers [Soviet polyethyleneterephthalate fiber and Soviet nylon-6 respectively]; the mechanical properties of which at room temperature are practically identical for most samples after the graft polymerization. MGF-9 and PN-1 polyester resins (i.e. unsaturated polyester–acrylate resin and polyester–maleate resin respectively) of standard purity were used as adhesives. Author

N69-19555# National Lending Library for Science and Technology, Boston Spa (England).
THE DETERMINATION OF HARDNESS, PLASTICITY AND RESISTANCE TO CRACKING IN RELATION TO WEAR OF SOME NON-METALLIC MATERIALS [DIE BESTIMMUNG VON HAERTE, VERFORMBARKEIT UND RISSBILDUNGSWIDERSTAND IM ZUSAMMENHANG MIT DEM VERSCHLEISS EINIGER NICHTMETALLISCHER STOFFE]
G. Gommel May 1968 10 p refs Transl. into ENGLISH from Materialpruefung (Duesseldorf), v. 9, no. 10, 1967 p 365–371
(NLL-LC-1419) Avail: Natl. Lending Library, Boston Spa, Engl.

Details are given on a penetration test method which employs a microhardness tester attached to a microscope. The Vickers test diamond and optical measuring facilities are seperate and are moved into the loading or observation position by horizontal displacement of the unit. Loading takes place by operation of the fine movement of the lens assembly in steps of 5, 10, 20, 50, and 100 gf using a torsion spring, while observing a loading scale. The materials investigated were partly manufactured and partly natural polycrystals. Figures are included to show: (1) The hardness of nonmetallic materials increases with diminishing test force. (2) The resistance to wear has an approximately linear relationship with the surface energy but only if the plastic deformation is about the same. (3) Very small scratch depths only cause plastic deformations and a high resistance to wear. Larger scratch depths cause an increase in cracking in and on both sides of the line. Author

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N69-18327 Pennsylvania Univ., Philadelphia.
AN APPLICATION OF VARIATIONAL PRINCIPLES TO STATISTICALLY NONHOMOGENEOUS FIELDS
Allan Ralph Somoroff (Ph.D. Thesis) 1967 227 p
Avail: Univ. Microfilms: HC $10.35/Microfilm $3.00 Order No. 68-9239

A number of physical problems are considered in which the fields are governed by differential equations with random coefficients. These coefficients are of both a constitutive and a non-constitutive nature. Particular interest is centered on fields that are statistically nonhomogeneous. Variational theorems of a classical nature have been applied to the derivation of upper and lower bounds on various physical quantities. The variational theorems have been utilized to obtain bounds on the ensemble average value of the heat flow from thin rods and fins and from certain three dimensional randomly heterogeneous bodies; in a similar manner the familiar theorems of minimum potential and complementary energy were used to treat certain problems governed by the field equations of linear elasticity. Elastically supported beams and plates were also considered. Dissert. Abstr.

N69-18433 Brandeis Univ., Waltham, Mass.
CROSSING OF HELICITY AMPLITUDES
Stanley A. Klein (Ph.D. Thesis) 1968 217 p
Avail: Univ. Microfilms: HC $9.90/Microfilm $3.00 Order No. 68-9936

The helicity crossing formalism of Trueman, Wick and Muzinich is examined together with the associated Lorentz transformation and analytic continuation. Various methods for handling Lorentz transformations are presented, including the use of symmetry within the Euclidean region. The analytic structure of helicity amplitudes is divided into its dynamic and kinematic aspects. To help understand the dynamical singularities we examine the location of branch points and cuts of partial-wave projections of general Born terms. The kinematic singularities which arise from the spin of the external particles are eliminated by defining helicity amplitudes free of kinematic singularities. The crossing matrices associated with these new amplitudes are also free of kinematic singularities, and are especially useful for reactions which involve fermions. We shall also derive the crossing matrix for transversality amplitudes. Dissert. Abstr.

N69-18458 New York Univ., N. Y.
PERTURBATION THEORY OF NONLINEAR BOUNDARY VALUE PROBLEMS IN MATHEMATICAL PHYSICS
Martin Harvey Millman (Ph.D. Thesis) 1968 86 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-13135

A common method for treating nonlinear problems in mechanical and electrical systems with one degree of freedom is the method for formal perturbation expansion with respect to a small parameter, the coefficients in these expansions being obtained as solutions of a sequence of linear problems. It is the purpose of this dissertation to show how the field of applicability of this technique can be extended to include systems of infinitely many degrees of freedom, i.e., physical systems whose mathematical descriptions lead to boundary value problems governed by nonlinear partial differential equations. Perturbation expansions of the solutions of a variety of problems of physical interest are obtained. As in the case of one degree of freedom, we find that the presence of nonlinearities gives rise to phenomena having no analogue in the linear theory. Dissert. Abstr.

N69-18500 Pennsylvania State Univ., University Park.
SIMULATION AND ANALYSIS OF NONLINEAR NETWORKS ON A DIGITAL COMPUTER
Pentti Antero Honkanen (Ph.D. Thesis) 1967 192 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 68-11990

The purpose of this investigation was to develop the necessary techniques and algorithms to allow the solution of a general nonlinear network on a large scale digital computer. The network equations describing a general nonlinear network were developed from basic principles to obtain a final formulation that describes the network as a set of nonlinear differential equations. Since these equations must be solved numerically, a method that gives the minimum set of equations was chosen. This formulation is the state variable form with the capacitive voltages and inductive currents chosen as the variables. The existence and uniqueness of the analytical solution was shown to exist if the partial derivatives of the parametric network functions are continuous functions. The stability of the system is guaranteed if the energy storage network parameters have bounded partial derivatives. Also, stability conditions, developed from a Liapunov function, were related to the network parameters, thus yielding a criteria for the stability of a general nonlinear network. Dissert. Abstr.

N69-18540 Princeton Univ., N. J.
A FUNCTIONAL CALCULUS FOR NON-COMMUTATIVE SELF-ADJOINT OPERATORS
Robert F. V. Anderson (Ph.D. Thesis) 1967 77 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-8903

A definition of functions of non-commutative self-adjoint operators is examined. Much attention is given to the qualitative study of T(A). A relationship between the spectra of the operators of the n-tuple and the convex hull of the support of T(A) is established. Among the main theorems about T(A) are those concerning an odd number n of operators on a finite dimensional Hilbert space. In many cases, including all 3-tuples of operators, T(A) is shown to be a smooth function on E^n except on an algebraic variety of codimension one in E^n. The method of proof involves a refinement of the Radon transform technique. A diverse group of examples is discussed. The spin 1/2 matrices are shown to have a joint spectral distribution whose support is the sphere of unit radius. The structure of the distribution for higher spin matrices is also examined. The coordinate and momentum operators are found to have a smooth function for their joint spectral distribution, permitting the definition of certain distribution functions of that pair of operators. Dissert. Abstr.

N69-18541 Pennsylvania State Univ., University Park.
ON GENERALIZED WALLMAN SPACES
Anthony Joseph D'Aristotle (Ph.D. Thesis) 1967 42 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-8675

In 1938 Wallman observed that a distributive lattice L with a zero and a unit generates a compact T_1 space S (the space of ultrafilters of L). In particular, if X is a T_1 space and L is the lattice of all closed subsets of X, then Wallman showed that X is homeomorphic to a dense subset of S so that S is a compactification of X. Several authors have modified Wallman's technique in various ways to obtain compactifications of a topological space as spaces of ultrafilters, and have thereby given rise to different types of Wallman spaces. The completely regular T_1 or Tychonoff spaces are precisely those topological spaces with Hausdorff compactifications. One of the best known compactifications of a Tychonoff space X is the Stone-Cech compactification βX, and it is characterized as that compactification of X in which X is C^*-embedded. If X is a Stone Separation space, we cannot hope

to embed it in a compact Stone Separation space. However, we did prove that corresponding to a Stone Separation space X there is a Wallman space Y which is a Z-compact Stone Separation space, and which contains X as a dense, C^*-embedded subset. Dissert. Abstr.

N69-18568 California Univ., Berkeley.
PROPER EMBEDDINGS OF OPEN MANIFOLDS IN EUCLIDEAN SPACE
David Harold Spring (Ph.D. Thesis) 1967 70 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 68-10414

Let M^n be a C^∞ open manifold. A continuous map $f : M^n \to R^k$ is a proper C^∞ embedding if, (1) $f: M^n \to R^k$ is a C^∞ embedding, (2) f is proper as a continuous map, i.e., if C is a compact subset of R^k, then f^{-1} (C) is a compact subset of M^n. Thom has defined Stiefel–Whitney classes and normal Stiefel–Whitney classes with sufficient generality to include the case of open C^∞ manifolds. Thus to an open C^∞ n-manifold M^n, there corresponds a normal class, $\overline{W}^i(M^n) \in H^i(M^n;T)$ if i is odd; and $\overline{W}(M^n) \in H^i(M^n;Z_2)$ if i is even, $1 \leq i \leq n$. Here T is the orientation sheaf of the manifold M^n. These normal classes respect the usual naturality properties. Dissert. Abstr.

N69-18585 Oregon State Univ., Corvallis.
PROBABILITY DENSITIES AND CORRELATION FUNCTIONS IN STATISTICAL MECHANICS
Chung-Y. Shen (Ph.D. Thesis) 1968 105 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-9595

A rigorous theory is presented of probability densities and correlation functions within the framework of the exponential spaces of D. S. Carter. This discussion is extended to include infinite systems. An algebra of complex-valued functions is considered defined on the exponential of a set. Mulitplication in this algebra corresponds to the star product used by Schwartz and Ruelle. A functional calculus is defined on this algebra, which provides for the discussion of Ursell functions. By introducing a special subspace of integrable functions, a systematic theory is obtained, in which probability densities and correlation functions belonging to this subspace are related by a pair of mutually inverse integral operators. The existence of states of an infinite system is established as limits of a special class of states of finite systems. The equilibrium states considered by Ruelle are shown to be included in this class. Dissert. Abstr.

N69-18601 Rochester Univ., N. Y.
BETA-ANALYTIC FUNCTIONS AND SPIN SPHERICAL HARMONICS
Munukutla Sitarama Krishna Sastry (Ph.D. Thesis) 1968 80 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-9395

The concept of a meta-analytic function is introduced and it is shown that a meta-analytic function exhibits some properties analogous to those of an ordinary analytic function. A particular subfamily of meta-analytic functions, called spin spherical harmonics, is used to obtain all the irreducible even-dimensional representations of SU(2)--the subgroups of the group of unitary transformations of a 2-dimensional unitary space whose determinant is 1. Functions are considered from an open subset of the Spin model of Euclidean 3-space into a 2-dimensional unitary space. Using the close connection between the Cauchy-Riemann equations and the Cauchy – Riemann operator ∇, the definition of an analytic function is generalized in terms of the Cauchy – Riemann equations to define the concept of a meta-analytic function. It is shown that for meta-analytic functions the analogs of Cauchy's theorem, the Cauchy integral formula, Morera's theorem and the maximum modulus principle hold. Dissert. Abstr.

N69-18676 California Univ., Berkeley.
NON-SEQUENTIAL OPTIMAL SOLUTIONS OF SEQUENTIAL DECISION PROBLEMS
Min-Te Chao (Ph.D. Thesis) 1967 75 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-10300

For the problem of sequential point estimation of a sequence of independently distributed random variables with a common distribution P_θ, $\theta \in \Theta$, it is well-known that the exact optimal solutions are extremely difficult to determine, except in a few special cases. By using a suitably chosen loss function, solutions with various optimality requirements can be obtained. The concept of asymptotically pointwise optimality (APO) is extended to the concept of weak APO. It is shown that, within a certain class T of stopping rules, WAPO-ness and asymptotically Bayes' solutions are equivalent. For the particular problem under consideration, a stopping rule $t(\cdot)$ is WAPO if and only if it tends to ∞ in probability with a fixed rate, say $t_0(c)$, as c, the factor of the cost per observation, tends to zero. The results serve as lemmas for the main theorems. Under standard large sample theory regularity conditions, it is shown: (1) by applying a modification to the loss function with a certain positive factor, there exists a fixed sample size decision rule which is both optimal in the asymptotically Bayes' sense with respect to all priors in a certain class and asymptotically minimax; and (2) the elements of the class of all optimal rules are essentially the same, i.e., of fixed sample size. Dissert. Abstr.

N69-18682 Tennessee Univ., Knoxville.
DIFFERENTIABILITY OF SET FUNCTIONS
Harvel Amos Wright (Ph.D. Thesis) 1967 65 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 68-9840

Let F represent a family of measurable subsets of Euclidean n-space such that if T is a set in F, then $|T| = |\overline{T}|$, where $|T|$ denotes the Lebesgue measure of T and $\overline{T}$ denotes the closure of T. Let f be an arbitrary real-valued function that is defined and finite on sets from the family F. Necessary and sufficient conditions are given for the derivatives to be finite almost everywhere, to be bounded almost everywhere, to be summable, and for a unique derivative to exist and be finite almost everywhere on a bounded and measurable subset of the set of points where these derivates are defined. Dissert. Abstr.

N69-18696 Wisconsin Univ., Madison.
BOUNDARY VALUE CONTROL OF DISTRIBUTED SYSTEMS CHARACTERIZED BY HYPERBOLIC DIFFERENTIAL EQUATIONS
John Joseph Grainger (Ph.D. Thesis) 1968 284 p
Avail: Univ. Microfilms: HC $12.85/Microfilm $3.65 Order No. 68-5307

Boundary value control produces changes in the internal states of a system by controls applied at the system boundary. The dynamic performance of systems in which changes in state are propagated with finite velocity from the boundary into the interior is usually governed by hyperbolic partial differential equations. The subject of this research is the boundary value control of those distributed parameter systems which are characterized by linear, hyperbolic, partial differential equations of the second order. Based on the method of characteristics a procedure is developed for generating the biorthogonal elements which characterize the boundary control forces for the distributed parameter systems considered. It is shown how the biorthogonal elements are used for measurement of state. A complete measurement and control procedure is presented. A computer program is devised which permits the numerical calculation of the biorthogonal functions for the nonuniform string equation. Representative worked examples are presented which illustrate the nature and performance of the controls under study. Dissert. Abstr.

N69-18704# Aeronautical Research Council (Gt. Brit.)
THE STABILITY OF BOUNDARY CONDITIONS IN THE NUMERICAL SOLUTION OF THE TIME-DEPENDENT NAVIER-STOKES EQUATION
P. J. Taylor (Southampton Univ.) 5 Aug. 1968 50 p refs
(ARC-30406) Avail: CFSTI

The stability of finite-difference schemes, including boundary conditions, for solving the time-dependent Navier-Stokes equations is investigated. The different types of boundary condition which may occur are listed and no-slip conditions are derived for a wall with suction. Stability analyses are completed for one dimensional problems with various types of boundary conditions, using schemes suitable for two-dimensional problems. All the conditions introduced are shown to be stable if there is no flow across the boundary. For suction at a fixed or moving wall, it is shown that the mesh size must be restricted for both accuracy and stability.
Author (ESRO)

N69-18740*# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
APPLICATION OF GROUP AND TRANSFORMATION THEORY TO THE SOLUTION OF ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS Final Report, 17 Jan. 1967–16 Jan. 1968
R. H. Martin, Jr., C. N. Driskell, Jr., and L. J. Gallaher 16 Jan. 1968 97 p refs
(Contract NAS8-20286; Proj. A-918)
(NASA-CR-98287) Avail: CFSTI CSCL 12A

The application of transformation groups to the solution of systems of ordinary differential equations and, in particular, partial differential equations is presented. These groups are Lie groups in the usual sense, but it is the transformation properties rather than the group structure that is used. The principal tool referred to as Lie's theorem gives a method for finding an integrating factor for a system of ordinary differential equations when the appropriate invariance group or groups can be found. Lie's theorem is extended to partial differential equations by considering a partial differential equation as a continuously infinite system of coupled ordinary differential equations. For a system of ordinary differential equations the integrating factor is a matrix. For a partial differential equation the integrating factor is a continuously infinite matrix. The proof of Lie's theorem and its use for partial differential equations depends on constructing an adequate theory of continuously infinite matrices; this is done here through the use of distributions or generalized functions.
Author

N69-18826# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
EXISTENCE CONDITIONS OF OPTIMAL TRAJECTORIES IN DYNAMIC CONTROL PROCESSES [CONDITIONS D'EXISTENCE DE TRAJECTOIRES OPTIMALES DES PROCESSUS DYNAMIQUES COMMANDES]
Libuska Bonnemay-Juricek Nov. 1968 219 p refs In FRENCH; ENGLISH summary
(CEA-R-3563) Avail: CFSTI

The existence of solutions in optimal control problems with free endpoints and existence conditions are established without the usual assumption that the control region is convex. The results are expressed in terms of conditions on the parameters defining the system.
Author (ESRO)

N69-18884*# Martin Co., Denver, Colo.
CONTROLLABILITY AND THE SINGULAR PROBLEM Semiannual Report
George W. Haynes Dec. 1968 41 p refs
(Contract NAS2-4896)
(NASA-CR-73300; MCR-68-238) Avail: CFSTI CSCL 12A

Briefly reviewed are notions and symbolism associated with the geometry of manifolds pertinent to the geometric differential approace to controllability. In general, for nonlinear systems, an extended geometrical interpretation of nonintegrability of pfaffians and neighborhoods of attained points can only be used to determine the existence or nonexistence of integral manifolds and establish whether or not some points are obviously inaccessible. For certain control systems where the control actuator vectors do not generate an "involutive distribution", Chow's theorem can be used to generate criteria for global controllability.
G.G

N69-18888 Case Western Reserve Univ., Cleveland, Ohio.
THE USE OF INFORMATION IN SORTING
Hiram Lynn Beus (Ph.D. Thesis) 1967 80 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-10140

This paper considers the information-gathering aspect of sorting(ordering) a set of items. A large class R of sorting algorithms is defined, and graded according to the amount of use that is made of the transitivity property. Properties of this class are developed, and attention is focused on a simple subclass R_2. It is shown that several well-known sorting algorithms are closely related to algorithms of R_2, and that one known algorithm, the Binary Tree Sort, is in this class. For $A \in R_2$ a vector $\eta(A)$ is defined which characterizes the information-gathering efficiency of A. Using graph theory the maximal vector $\eta(A)$ for $A \in R_2$ is determined. Progress is made on the problem of finding the minimal such vector, and it is conjectured that this minimal vector is associated with the most efficient algorithms of R_2. The Binary Tree Sort appears to be such an algorithm.
Dissert. Abstr.

N69-18889 California Univ., Berkeley.
CRITICAL POINTS OF THE DISPLACEMENT FUNCTION OF AN ISOMETRY
Vilnis Ozols (Ph.D. Thesis) 1967 75 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 68-10391

This thesis discusses the set of critical points of the function δ_f^2, where $f : M \to M$ is an isometry of a Riemannian. We induced the Strong Operator Topology in the set $A[T_1, T_2, \ldots T_N]$, and proved various theorems.
Dissert. Abstr.

N69-18906*# Techtran Corp., Glen Burnie, Md.
STUDY OF THE ASYMPTOTIC EXPANSION OF THE MULTIPLE INTEGRALS OF MATHEMATICAL PHYSICS [ETUDES SUR LES DEVELOPPEMENTS ASYMPTOTIQUE DES INTEGRALES MULTIPLES DE LA PHYSIQUE MATHEMATIQUE]
N. Chako Washington NASA Jan. 1969 86 p refs Transl. into ENGLISH from the French Report, CEA-R-3263
(NASA-TT-F-12082; CEA-R-3263) Avail: CFSTI CSCL 12A

Two theorems are proven indicating that the principle contributions of the integral are due to small neighborhoods around critical or stationary points, expressed in decreasing or asymptotic series of the large parameter. Using these theorems, the stationary phase method is extended to double and multiple integrals. The asymptotic form of the principle contribution is analyzed, and applications are outlined.
Author

N69-18938# Wisconsin Univ., Madison. Mathematics Research Center.
THE QUADRATIC CRITERION FOR DISTRIBUTED SYSTEMS Technical Summary Report
D. L. Lukes and D. L. Russell Mar. 1968 34 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-679487; MRC-TSR-860) Avail: CFSTI CSCL 12/11

The article explores the applicability of the quadratic criterion of optimality to the control of distributed parameter systems or,

alternatively, to differential equations in a Hilbert space. It is shown that such application is indeed possible and, perhaps more important from the engineering point of view, that the optimal controls thus found are limits of optimal controls corresponding to finite dimensional models of the distributed or infinite dimensional system. The theory is first developed in an abstract setting and then applied to specific examples. Author (TAB)

N69-18959 Michigan Univ., Ann Arbor.
OPTIMAL CONTROL OF DISCRETE TIME, RANDOM PARAMETER SYSTEMS
Joseph Norton Gittelman (Ph.D. Thesis) 1967 514 p
Avail: Univ. Microfilms: HC $23.20/Microfilm $6.55 Order No. 68-7609

The dissertation models the random plant in terms of a function space of random variables. This formulation permits a state description of the plant through the conditional probability distribution of the random variables' sample values. Moreover, the information or data acquired during a particular control run can then be incorporated into the updating of the conditional probability distribution. The modelling technique is then applied to two problems. The first problem is an extension to the problem of regulating a linear plant with channel noise. The optimal policy is obtained. The second problem is the regulation of a linear, random parameter plant. Dissert. Abstr.

N69-18960# Los Alamos Scientific Lab., N. Mex.
THEORETICAL SMALL PARTICLE STATISTICS: A SUMMARY OF TECHNIQUES FOR DATA ANALYSIS WITH RECENT DEVELOPMENTS IN DATA COMPARISON, NOTATION, AND MIXTURE THEORY
H. D. Lewis and A. Goldman 8 Nov. 1968 54 p refs
(Contract W-7405-ENG-36)
(LA-3656) Avail: CFSTI

A rigorous development of methods for particle size data analysis based upon the form of the data generated by the various methods available for measurement of particle size distributions is presented. Data are classified into two general types, and methods for computing and comparing sample statistics are developed on the basis of Type I and II classifications for both the functional and nonfunctional representations of the sample data. An attempt is made to demonstrate the compatibility of recognized statistical notation and definition with the problem of particle size data analysis. A general theory and required notation is developed for description of mixtures of particulate systems. Application of the general theory for mixtures in the study of packing behavior of particulate systems is discussed. Formulas for computing and comparing sample statistics generated by the various particle size measurement methods are summarized. Author (NSA)

N69-18963 Colorado Univ., Boulder.
SOME REPRESENTATION THEOREMS AND THE AMALGAMATION PROPERTY IN ALGEBRAIC LOGIC
Stephen Daniel Comer (Ph.D. Thesis) 1967 99 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-10584

Conditions under which a class K of abstract algebras has the amalgamation property are discussed. Analysis indicates that there are a large number of finitely axiomatizable equational classes of Boolean algebras with operators for which the amalgamation property fails. A similar sufficient condition is applied to obtain negative results for the embedding property, whose formulation is similar to that of the amalgamation property. Also discussed are the representation problem and the problem of characterizing the injective algebras of various classes of cylindric and polyadic (equality) algebras. Dissert. Abstr.

N69-18964 Pennsylvania State Univ., University Park.
THE GREEN EQUIVALENCES AND HOMOMORPHISMS ON COMPACT SEMIGROUPS
Albert Robert Stralka (Ph.D. Thesis) 1967 50 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-8749

The Green equivalences on compact semigroups of dimensions zero and one, homomorphisms on zero-dimensional semigroups, Rees-simple semigroups, and the topological structure of D-classes of compact semigroups were investigated. Dissert. Abstr.

N69-19173# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Systems Research Section.
ON FINDING THE OPTIMUM: A NEW LOCATION TECHNIQUE
G. E. Taylor Jan. 1969 15 p refs
(RM-439) Avail: Issuing Activity

Mathematical techniques for locating the optimum solution to multivariable problems were discussed. Recent efforts have been in the direction of greater utilization of the massive, fast computer. The emphasis has moved from the gradient and Newton–Raphson techniques, with the attendant high-order derivatives required, to the modified Davidon method (MDM), which requires only first derivatives or their approximations, then on to direct function search (DFS) techniques, which require no derivatives. From an evaluation of available techniques on a series of sample test problems, we have concluded that a composite of a crude DFS and an efficient MDM will best locate the optimum in the smallest amount of computer time, at the same time providing the analyst with an overview of the problem surface as well as a good degree of confidence that the global optimum has been found. Author

N69-19239 Wisconsin Univ., Madison.
THE EFFECTS OF SAMPLING AND INTERPOLATION IN ISARITHMIC MAPPING
Joel Lynn Morrison (Ph.D. Thesis) 1968 203 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 68-7117

The factors contributing to the most error free production of an isometric map by machine and determination of the magnitude of the error in the resulting map are approached by testing in hypothetical situations the components which are basic to all existing and possible future computer programs. The five elements which interact to create discrepancies between a phenomenological surface and its isarithmic map representation are described, as well as the four surfaces used in the experiment; these are defined by mathematical functions of varying degrees of complexity and possess different types of variation. The reconstructed isarithmic surfaces derived are compared to their respective parent surfaces by observing the volumes beneath the surface shells, computing the standard deviation of the residuals, and computing a coefficient of correlation between the surface heights of the reconstructed surface and its parent surface. The three sets of comparisons are then used in a three-way analysis of variance for each surface. A statistic, consisting of the standard deviation of the residuals divided by the surface standard deviation and multiplied by 100, is devised in order to compare the magnitudes of the effects produced by these three factors. Dissert. Abstr.

N69-19280 California Univ., Berkeley.
STRUCTURE OF SOME COCYCLES IN ANALYSIS
Annie Watkins Garraway (Ph.D. Thesis) 1967 59 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-10326

Let G be a separable locally compact group, H a closed subgroup of G, and λ a finite measure in G which is equivalent to Haar measure. Let K be an analytic Borel H-space, and τ a finite measure in K which is quasi-invariant under the action of H. Let

B be the space of equivalence classes of $K\times G$ under the H-action $h\cdot(k,g) = (hk,gh^{-1})$ for $h \in H$, $(k,g) \in K\times G$. B is a Borel G-space under the action $g\cdot[(k,g')] = [(k,gg')]$. If $p: K\times G \to B$ is the canonical map, let $\nu = p_*(\lambda\times\tau)$. Let $\bigcup(B)$ (resp. $\bigcup(K)$) be the group of unitary ν-measurable (resp. τ-measurable) functions on B (resp. K). The main theorem is that $H^1(G, \bigcup(B)) \approx H^1(H, \bigcup(K))$, where $H^1(G, \bigcup(K))$ are the modified one-dimensional Eilenberg–MacLane cohomology groups. This theorem is used to prove that $H^1(R, \bigcup(B)) \approx H^1(Z, \bigcup(K))$, where B is the Bohr group, and K is the compact subgroup of B annihilating $2\pi \in B$.
Dissert. Abstr.

N69-19358# Joint Publications Research Service, Washington, D. C.
APPROXIMATION OF THE DYNAMIC CHARACTERISTICS IN A CLASS OF GENERALIZED FUNCTIONS
V. K. Zadiraka et al *In its* Cybernetics and Regulation Theory, USSR 13 Feb. 1969 p 1–7 refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 83, no. 5, 1968 p 1024–1027 (See N69-19358 08-34)
Avail: CFSTI

Theorems are proved for input and output functions of a real object by direct and inverse Fourier transformations, Faber polynomials, and Bernstein inequality.
B.P.

N69-19459 Oregon Univ., Eugene.
STAR REPRESENTATIONS OF PSEUDONORMED ALGEBRAS WITH INVOLUTION
James Myron Franklin (Ph.D. Thesis) 1967 139 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-9990

Star representations of normed algebras with involution, as linear continuous operators on a Hilbert space, are generalized to the case of a pseudo-normed algebra which does not necessarily have a continuous involution. With a slightly different definition of admissibility, each admissible positive linear functional on a pseudo-normed star algebra generates a Hilbert space and a star representation characterizable iff $\alpha < \delta_{(\omega)}$. Several theorems about definability in an applied second order language for number theory are also included, as well as investigation of the characterizability of various large cardinals.
Dissert. Abstr.

N69-19589 National Lending Library for Science and Technology, Boston Spa (England).
ON MARKOVIAN SPECTRUM [O SPEKTRE MARKOVA]
G. A. Freiman et al Jan. 1969 7 p refs Transl. into ENGLISH from Litovsk. Math. Sbornik (Vilna), no. 6, pt. 3, 1966 p 443–447 (NLL-RTS-4754) Avail: Natl. Lending Library, Boston Spa, Engl.: 12s 6d

A refinement in the structure of Markovian spectrum is presented. Starting from a series denoting the sequence of natural numbers, infinite on both sides, it is proven that the numbers from 5.118 to 5.583 belong to the Markovian spectrum. A further refinement is obtained by proving that a previously derived interval between 5.583 and 5.681 belongs to the spectrum.
F.O.S.

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N69-18579# Centre National d'Etudes Spatiales, Bretigny-sur-Orge (France). Div. Satellites.
AN INTRODUCTORY ACCOUNT OF THE OPERATIONAL MODES OF EOLE PROJECT [EXPOSE GENERAL SUR LE FONCTIONNEMENT DU PROJET EOLE]
B. Lehmann 7 Mar. 1968 42 p In FRENCH Presented at the CNES Symp. on Space Technol., Bretigny, France, 12 Mar.–2 Apr. 1968
Avail: CFSTI

The format of the call and the orders transmitted to each individual Eole balloon is analyzed. The principles of the system for measuring the satellite-balloon distance are explained and a description of the meteorological data transmitted from each balloon to the satellite is given.
ESRO

N69-18789# Centre National d'Etudes Spatiales, Bretigny-sur-Orge (France).
EOLE PROJECT: A GENERAL DESCRIPTION [LE PROJET EOLE: DESCRIPTION GENERALE]
J. Muller [1968] 34 p In FRENCH Presented at the CNES Symp. on Space Technol., Bretigny, France, 12 Mar.–2 Apr. 1968
Avail: CFSTI

The aim of the Eole project which will be comprised of some 450 sounding balloons transmitting data to an orbiting satellite is to establish a global system for the measurements of wind velocities. The program objectives are analyzed and the density of the balloons, their altitudes, sensors and transmitter's are discussed; problems related to the launching of the balloons and aircraft safety are also considered. In addition, the results of preliminary trials and the details of future launching programs are presented.
ESRO

N69-18795# Centro Nazionale di Fisica dell'Atmosfera e Meteorologia, Rome (Italy).
SOME PRELIMINARY HAIL AND THUNDER STATISTICS FOR VERONA, ITALY AND ITS SURROUNDING PROVINCE
Griffith M. Morgan and Emilio Bellavite (UCMEA, Verona, Italy) Consiglio Nazl. delle Ric. Apr. 1968 19 p
(CENFAM-RDP-22) Avail: CFSTI

Data are given for the hailstorms and thunderstorms per decade in the region of Verona, Italy, from 1948 to 1966 and they are then analyzed.
ESRO

N69-18799# Centro Nazionale di Fisica dell'Atmosfera e Meteorologia, Rome (Italy).
NET HEAT FLUX MEASUREMENTS AT FIUMICINO (ROMA) [SONDAGGI DI FLUSSO NETTO A FIUMICINO (ROMA)]
F. Brademante, F. Giusti, and S. Santi Consiglio Nazl. delle Ric. Dec. 1966 40 p refs In ITALIAN Submitted for publication
(CENFAM-RDP-7) Avail: CFSTI

A net heat flux radiometer is described and the calibration procedures and error analysis are discussed. The radiometer was attached to a radiosonde and the data obtained in the Rome area are presented.
ESRO

N69-18821# Centro Nazionale di Fisica dell'Atmosfera e Meteorologia, Rome (Italy).
ACTIVITY AND RESEARCH PROJECT AT CENFAM IN THE FIELD OF AIR POLLUTION [RAPPORTO SULL'ATTIVITA' ED IL POSSIBILE RUOLO DEL CENFAM NEL CAMPO DEI PROBLEMI DELL'INQUINAMENTO ATMOSFERICO]
Maurizio Giorgi Consiglio Nazl. delle Ric. Dec. 1966 9 p In ITALIAN Presented at the Comm. for the Coord. of Activity in Atmospheric Pollution Res., 5 Dec. 1966 Submitted for publication
(CENFAM-RDP-9) Avail: CFSTI

Research programs to be undertaken by the CENFAM (Italy), concerning atmospheric impurities and contamination, are discussed.
ESRO

N69-19050*# Standard Research Inst., Menlo Park, Calif.
STUDIES OF VERTICAL WIND PROFILES AT CAPE KENNEDY, FLORIDA Final Report

R. M. Endlich, R. C. Singleton, K. A. Drexhage, and R. L. Mancuso Sep. 1968 95 p refs
(Contract NAS8-21148)
(NASA-CR-98348) Avail: CFSTI CSCL 04B

Methods of forecasting vertical wind profiles for NASA operations in launching missiles and spacecraft are discussed. The first subject considered is the structure, persistence, and predictability of details of vertical wind profiles. This portion of the investigation is based on sequences of wind profiles measured at Cape Kennedy, Florida, using the FPS-16 radar/Jimasphere technique. The details of the flow are shown by wind measurements at 25 m intervals between the surface and the lower stratosphere. The main analytical tool used is spectrum analysis. Spectra were computed using the fast Fourier transform rather than the more common but less efficient lagged product method. In the second portion of the study, numerical methods of forecasting the general wind profile for periods twelve to twenty-four hours in advance are described. These methods are based on objective analyses of standard wind observations. The forecast is made by advection of fields of wind components, vorticity, and divergence. Winds are matched to the forecast vorticity by a direct method. Test results indicate that the technique can be applied rapidly and is at least as accurate as other methods presently in use. Author

N69-19065# World Meteorological Organization, Geneva (Switzerland). Secretariat.
METHODS IN USE FOR THE REDUCTION OF ATMOSPHERIC PRESSURE
1968 32 p
(WMO-No.226.TP.120; TN-91) Avail: CFSTI

A survey of methods used by 107 members indicates that there are three major techniques used to reduce atmospheric pressure to that of mean sea level. The first method is based on a Laplace formula in which the geometric altitude of the station elevation is entered, and a correction for humidity, in most cases, is neglected. The second uses geopotential units, usually taking into account the correction for humidity. The third method represents a mixed variation of these two techniques or is based on an approximation formula designed for special cases. A list of countries according to the method employed for pressure reduction is included. The Laplace formula and the recommended hypsometric equation are described in detail in order to allow a comparison between the two methods. Author

N69-19237# National Research Council of Canada, Ottawa (Ontario). Aeronautical Establishment.
TURBULENCE MEASUREMENTS AT LOWER LEVELS AROUND A SQUALL LINE
G. K. Mather and D. S. Treddenick Jan. 1969 19 p ref
(NRC-10582; LR-515) Avail: CFSTI

A cooperative program of storm turbulence measurement was conducted, with control of the aircraft being exercised from the National Severe Storms Laboratories at Norman, Oklahoma. The object was to explore turbulence intensities around thunderstorms and through radar "gaps" in squall lines between 5,000 and 15,000 feet. A squall line southeast of Oklahoma City was investigated, the T-33 being directed through essentially echo-free holes in the line. Moderate to severe turbulence was encountered in these gaps. Time histories and power spectra of the turbulence are presented, and some conclusions are drawn as to their implications to airline operations at these lower heights in severe storm situations. Author

N69-19274# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
MICROMETEOROLOGICAL EXPEDITIONS 1962–1964
W. C. Swinbank and A. J. Dyer 1968 48 p refs *Its* Div. of Meteorological Phys. Tech. Paper No. 17
Avail: CFSTI

Five expeditions were undertaken at two specially selected sites for the purpose of acquiring high quality observations of the vertical distributions of wind, temperature, and humidity in the 16 m of air above the ground surface, together with other relevant variables, including the net radiation, the vertical fluxes of sensible heat and of water vapour, and the heat flux into the ground. The sites were chosen for horizontal uniformity, and observations were restricted to steady-state conditions, thereby ensuring the constancy with height of the fluxes of heat, water vapour, and momentum necessary to assess the validity of the various formulations that have been proposed to relate the fluxes to their respective vertical gradients. The experimental techniques and procedures are briefly described, and the results are presented in tabular form. Author

N69-19334 National Lending Library for Science and Technology, Boston Spa (England).
THE USE OF THE THEORY OF GAMES IN FORECASTING THUNDERSTORMS
V. I. Iljuhin et al 12 Nov. 1968 13 p refs Transl. into ENGLISH from Glav. Uprav. Gidromet. Sluzh. Met. Gidr. (Leningrad), no. 4, 1968 p 49–55
(NLL-M-559-(9022.551)) Avail: Natl. Lending Library, Boston Spa, Engl.

General principles of the theory of games are developed; algorithms for forecasting thunderstorms are based on this theory, along with an example of the realization of one of these algorithms. Author

N69-19392*# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
PROJECT FOG DROPS: INVESTIGATION OF WARM FOG PROPERTIES AND FOG MODIFICATION CONCEPTS
Quarterly Progress Report
Warren C. Kocmond and Roland J. Pilie 15 Feb. 1969 21 p refs
(Contract NASr-156)
(NASA-CR-100115; RM-1788-P-22) Avail: CFSTI CSCL 04B

Experiments were conducted to determine the effects of seeding dense natural fog with carefully sized hygroscopic particles. This concept was evaluated by seeding fogs from the ground and from the air. A total of 31 experiments was conducted, 25 of which were with ground seeding apparatus during the period May–September 1968; six were aerial seedings of dense valley fog during October 1968. Elmira, N. Y., was selected as the site because of its high fog frequency. The data collected during the experiments were analyzed, and the results are presented in this report. K.W.

N69-19394 National Lending Library for Science and Technology, Boston Spa (England).
ON A TWO-YEAR PERIODICITY IN THE FREQUENCIES OF TYPHOONS
E. N. Fadiceva [1968] 14 p refs Transl. into ENGLISH from Cent. Inst. Prog., T. (Moscow), no. 152, 1966 p 73–79 In ENGLISH and RUSSIAN
(NLL-M-7471-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

The biennial frequency of typhoons is found from data for 1940–64 using the method of overlapping 12-month means. Its relationship to the similar period in zonal wind components in the lower stratosphere over the equator is determined. The possibility of explaining this periodicity by taking account of the deformation forces which arise when the speed of rotation of the atmospheriod changes is pointed out. Author

N69-19410# National Center for Atmospheric Research, Boulder, Colo.
OBJECTIVE ANALYSIS ON ISENTROPIC SURFACES
Rainer Bleck and Philip L. Haagenson Dec. 1968 32 p refs
(NCAR-TN-39) Avail: Issuing Activity

Objectively analyzed data fields on several pressure surfaces (made available by the National Meteorological Center, NMC) are converted by means of a coordinate transformation, into data fields on isentropic surfaces. Due to the large vertical distance between the standard pressure surfaces, this conversion process produces only approximate values of the desired parameters on the isentropic surfaces. Radiosonde data, processed to make them applicable in an isentropic coordinate system, are used to improve the analysis. Since there is very little chance to improve the analysis over ocean areas (because only regular radiosonde observations are used), it is important to perform the transformation from isobaric to isentropic data as accurately as possible. Author

N69-19448# Texas Univ., Austin. College of Engineering.
MESOSCALE STRUCTURE OF THE TEXAS COAST SEA BREEZE
Shih-Ang Hsu Jan. 1969 284 p refs
(Grant NSF GA-367X)
(Rept-16) Avail: Issuing Activity

Meteorological data from the upper Texas coast affords a clearer view of the sea breeze circulation system. Networks of surface observations, of pibal and radiosonde ascents and of aircraft flights have produced observations required for the synthesis of an empirical model. Experiments on several scales were conducted so that critical portions of the system could be more carefully described. Non-sea breeze phenomena were examined with respect to their disturbing and masking effect on the local sea breeze. In this study the hypothesis of land and sea breeze systems are verified. The frontal characteristics of the sea breeze and the clockwise rotation of the system with time due to the coriolis effect are observed. The energy conversion processes of the sea breeze are also studied. These observations are assembled to give a synthesized model of this particular sea breeze circulation system as a function of space and time. Author

N69-19503# Joint Publications Research Service, Washington, D. C.
METEOROLOGY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space No. 197 30 Jan. 1969 p 7-20 refs (See N69-19501 08-34)
Avail: CFSTI

Reports presented during the conference on actinometry and atmospheric optics discussed principles of operation for actinometric instruments, brightness measurements on the cloud-atmospheric system, and meteorological interpretations of various atmospheric and geophysical measurements for weather forecasting purposes. G.G.

N69-19509 National Lending Library for Science and Technology, Boston Spa (England).
ON THE ADVISABILITY OF TAKING ACCOUNT OF SPECIAL FEATURES OF FORERUNNERS OF SUMMER IN MAKING A WEATHER FORECAST FOR MAY AND JUNE
N. A. Sevalkina 1968 8 p refs Transl. into ENGLISH from Gidromet. Nauch. Issled. Cent. SSSR (Leningrad), no. 21, 1968 p 63-68
(NLL-M-561-(9022.551)) Avail: Natl. Lending Library, Boston Spa, Engl.

Although the greater parts of the months of May and June belong to the same natural synoptic season, dissimilarities have often been observed in the distribution of air temperature over the European U.S.S.R. As a result, it has become impossible to accurately forecast the general weather patterns for both of these months using the forecasts of prevailing macroprocesses in the natural synoptic season of the first half of summer. A study was therefore initiated to study the sequence of development of atmospheric macroprocesses in order to use the special features of the natural synoptic season to obtain more accurate predicitons for the given months. The geometrical similarity of the charts of the mean values of H_{500} were determined for the forerunners of the natural synoptic season of pre-winter and for October, November, and December by means of specific parameters which indicate the degree of similarity between the H_{500} fields being compared. Data for the natural synoptic seasons of the first half of summer and all forerunners over the past 29 years were examined, and relationships established for use in preparing an accurate forecast of the air temperature anomaly and the amount of precipitation for May and June in the given area. A.C.R.

N69-19528# Joint Publication Research Service, Washington, D. C.
METEOROLOGY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space No. 198 13 Feb. 1969 p 8-22 refs (See N69-19526 08-34)
Avail: CFSTI

Rain gage capacities, weather forecasting methods, and processing of hydrometeorological information are prominent topics discussed. Included abstracts of studies emphasize atmospheric measurements and models as well as hydrometeorological work. G.G.

N69-19532 National Lending Library for Science and Technology, Boston Spa (England).
PLUNGING DEPRESSIONS AND JET STREAMS
V. F. Chernova 1968 9 p refs Transl. into ENGLISH from Gidromet. Nauch. Issled. Cent. SSSR (Leningrad), v. 22, 1968 p 62-69
(NLL-M-7483-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

The occurrence of large errors in predicting certain types of depression by synoptic methods, particularly as related to the movement of plunging depressions which move into the European U.S.S.R. and the northern seas led to a verification of the synoptic forecasts made in 1965. Analysis of the errors in predicting the centers for such depressions showed that a need exists for new methods for of forecasting and resulted in a study of the possibility of forecasting the movement of plunging depressions over the above areas based on the structure of the jet stream. Data from the period 1959-1961 were analyzed and led to three conclusions: (1) If the jet stream branches in the direction of the main flow, the plunging depression will move into the area under discussion in a movement nearly parallel to the main jet stream. (2) If there are two jet streams which converge into one downstream, no plunging depression will occur; it either moves eastward or remains slow moving and begins to fill up. (3) If one jet stream exists, which is anticyclonically curved downstream, there will be no depression, even if diffluent contours occur ahead of the depression in the lower half of the troposphere. These propositions are further backed up by an analysis of 1965 events. A.C.R.

N69-19538# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
STUDIES ON INTERACTION BETWEEN SYNOPTIC AND MESOSCALE WEATHER ELEMENTS IN THE TROPICS
Herbert Riehl and Robert P. Pearce Jun. 1968 66 p refs *In* Atmospheric Sci. Paper No. 126
(Grant E-22-138-67(G))
(REPT-1) Avail: Issuing Activity

CONTENTS:

1. SOME ASPECTS OF CUMULUS-SCALE DOWNDRAFTS. PART 1 H. Riehl 32 p refs (See N69-19539 08-20)

2. VORTICITY BUDGETS DERIVED FROM CARIBBEAN DATA R. P. Pearce 32 p refs (See N69-19540 08-20)

N69-19539# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
SOME ASPECTS OF CUMULUS-SCALE DOWNDRAFTS, PART 1
H. Riehl *In its* Studies on Interaction Between Synoptic and Mesoscale Weather Elem. in the Tropics Jun. 1968 32 p refs
(See N69-19538 08-20)
Avail: Issuing Activity

Initial results from several Carribean disturbances are presented. The disturbances were analyzed to determine whether the downdraft effect could be observed regularly and whether it existed both in steady state and in hurricane producing waves in the easterlies. The energy transfer from the ocean surface was analyzed in relation to changes in the moisture structure of the subcloud layer. An attempt was made to compute turbulent mass and vorticity transfer along the vertical within the synoptic-scale setting. From the thermodynamic standpoint it was found that the evaporation from falling rain is a powerful deterrent to amplification of waves in the easterlies. K.W.

N69-19540# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
VORTICITY BUDGETS DRIVED FROM CARIBBEAN DATA, PART 2
R. P. Pearce *In its* Studies on Interaction between Synoptic and Mesoscale Weather Elem. in the Tropics Jun. 1968 32 p refs
(See N69-19538 08-20)
Avail: Issuing Activity

As part of a quantitative description of tropical disturbances, the synoptic-scale vertical motion is determined and its relation to the vorticity field is considered. Five synoptic periods comprising 14 map periods in the Carribean were selected for analysis. The data were obtained by radiosondes and surface observations. A purely kinematic analysis was conducted based on wind and dewpoint data. Temperature and isobaric height data, although available, were eventually discarded after abortive attempts at smoothing. The wind data were subjectively analyzed at each of the standard levels between 1000 and 150 mb by drawing streamlines and isotachs. The speeds and directions were read into a computer, which calculated W-E and S-N components at each point. These components were smoothed to remove small vertical inconsistencies. A vorticity equation was derived by studying the vorticity budgets and their implications. K.W.

N69-19553# Texas Univ., Austin. College of Engineering.
A CLOUD CENSUS INVESTIGATION FOR THE TEXAS HIGH PLAINS
Donald R. Hargan Jan. 1969 77 p refs
(Contract IAC(68-69)-175)
(Rept-17) Avail: Issuing Activity

The annual and diurnal variations of cloud types and cloud amounts are described for three first-order weather stations in the Texas High Plains. These stations are Amarillo, Lubbock, and Midland. The data analyzed were obtained on punched-cards from the National Weather Records Center at Asheville, North Carolina. The period of record was from January 1, 1952 to December 31, 1961. A brief description of the data available along with reduction techniques is included. The effect of observational errors is discussed. Author

N69-19574 National Lending Library for Sciences and Technology, Boston Spa (England).
ON THE USE OF FORERUNNERS OF AUTUMN IN MAKING WEATHER FORECASTS
N. M. Zaharova 10 Dec. 1968 9 p refs Transl. into ENGLISH from Tr. Leningr. Gidrometeorol. Inst. (Leningrad), no. 21, 1968 p 99–74
(RLL-M-583-(9022.551) Avail: Natl. Lending Library, Boston Spa, Engl.

The use of the principle of analogy, based on analyzing the forerunners of natural synoptic seasons, in forecasting the air temperature anomaly and precipitation for the month of September in the U.S.S. R. is discussed. For each natural synoptic season of autumn, two forerunners are found: one period is not characteristic of that for the first half of summer, and the other is the first non-typical period in the natural synoptic season of the second half of summer. To determine the degree of similarity between the first and second forerunners, charts of the mean values of H_{500} fields for the period 1938 to 1966 were compared. Values for those with geometrical similarity were then calculated based on specified parameters and established formulas used in previous analyses of this type. As a result, it was found that the degree of similarity between the H_{500} fields for the first and second forerunners can be divided into three basic groups. Further analysis of each of these groups led to the conclusion that a basic relationship exists between the structure of the natural synoptic autumn season and its forerunners. A.C.R.

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N69-18601# Royal Aircraft Establishment, Farnborough (England).
A SOLAR ASPECT SENSOR FOR SATELLITE ARIEL 3
S. Craig Jun. 1968 40 p refs
(RAE-TR-68128) Avail: CFSTI

The design of a solar aspect sensor for Ariel 3 is described. A review has been made of factors which influenced the design and which are common to many photoelectric attitude detectors in near earth orbit. Sun-angles measured continuously by orbiting sensors are compared with sun-angles obtained from satellite attitude measured intermittently by earth based systems. Author (ESRO)

N69-18820# Centre National d'Etudes Spatiales, Bretigny-sur-Orge (France).
DESIGN OF D-2 SATELLITE STABILIZATION SYSTEM [LA CONCEPTION ET LE DEVELOPPEMENT DE STABILISATION DU SATELLITE D-2]
Y. Larance and J. L. Maury 14 May 1968 72 p In FRENCH Presented at the CNES Intern. Colloq. on Satellite Attitude and Stabilization, Bretigny, France, 8–11 Oct. 1968
Avail: CFSTI

A broad outline of the French D-2 satellite stabilization system is presented. The performances of the attitude control system of this gyrostabilized satellite are discussed and a computer simulation of the system described. ESRO

N69-18832# Centre National d'Etudes Spatiales, Bretigny-sur-Orge (France). Div. Etudes et Developpements Techniques.
APPLICATION OF FLUIDICS TO GUIDANCE AND ATTITUDE CONTROL OF SATELLITES AND SOUNDING ROCKETS [APPLICATION DE LA FLUIDIQUE AU CONTROLE D'ATTITUDE ET AU PILOTAGE DES SATELLITES ET DES FUSEES]
J. P. Pujes [1968] 33 p refs In FRENCH; ENGLISH summary Presented at the CNES Intern. Colloq. on Satellite Attitude and Stabilization, Bretigny, France, 8–11 Oct. 1968
(Rept-1012-PR/ED) Avail: CFSTI

This document is devoted to a general survey of fluidics and its applications. It includes a brief description of the principal fluidic devices. Attitude control and guidance of satellites, space probes and rockets are also dealt with. Author (ESRO)

N69-19167# Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.
ILS FLIGHT INSPECTION POSITIONING SYSTEM Final Report
C. H. Grauling, Jr. Jul. 1968 100 p
(Contract FA-65-WA-1372)
(SRDS-RD-68-45) Avail: Issuing Activity

The ILS flight inspection positioning system provides a precise determination of aircraft angular position with respect to a ground reference, and thus furnishes a means for calibrating an Instrument Landing System. The equipment described in this report represents the feasibility model of a system designed to permit accurate flight inspection of Category I, II, and III Instrument Landing Systems. The technique can also be employed as a precision landing system with pilot selectable glide path. The high positioning accuracy is obtained by mapping a small angle in space onto a large electrical phase angle. The system has demonstrated satisfactory operation even at a difficult site. Author

N69-19170# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
PROPOSALS FOR POSSIBLE PLATFORM SUSPENSION SYSTEMS FOR THE LAS
H. M. Briscoe and D. C. Clayton Paris ESRO Mar. 1967 43 p ref
(ESRO-TM-P-96-ESTEC) Avail: CFSTI

One concept of the Large Astronomical Satellite envisages the use of a stellar reference platform to provide a stable space reference axis about which the experimental package will be slewed. This Note examines four possible platform suspension arrangements with particular reference to pointing axis alignment errors arising from mecahnical and thermal sources and discusses the advantages of a cantilever platform with closely spaced bearing parts in the event of a star reference platform being used for the L.A.S. ESRO

N69-19171# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
LARGE ASTRONOMICAL SATELLITE. FINE ATTITUDE CONTROL
D. Marsh Paris ESRO Apr. 1966 9 p
(ESRO-TM-P-130-ESTEC) Avail: CFSTI

The problem of fine attitude control is discussed, including the results and status of current work. Theoretical studies have been carried out and are being extended to experimental work to try to establish the limitations of a practical system. The principles involved in the fine control system concern refinements permitting higher pointing accuracy. Author (ESRO)

N69-19252*# GCA Technology Div., GCA Corp., Bedford, Mass.
YAW ATTITUDE SENSOR Final Report, 23 Jun. 1965–15 Feb. 1968
Wallace S. Kreisman Jan. 1969 145 p refs
(Contract NAS5-9642)
(NASA-CR-100151; GCA-TR-67-19-N) Avail: CFSTI CSCL 22B

A yaw attitude sensor system was designed and constructed to measure the angle between a chosen axis of a space vehicle and the relative wind. The system works by periodically connecting a cold cathode ionization gauge, via a mechanical cycling valve, to one of two independent tubulations that extend beyond the vehicle surface and are symmetrically located about the vehicle chosen axis. The ionization gauge measures the low pressures that develop within the tubulations and delivers a modulated output signal to a logarithmic electrometer and synchronous detector. The gauge signal modulation amplitude is converted to a dc voltage which is proportional to the yaw angle. Author

N69-19335*# Control Data Corp., Minneapolis, Minn. Aerospace Research Dept.
STUDY OF A SCANNING CELESTIAL ATTITUDE DETERMINATION SYSTEM (SCADS) FOR A SYNCHRONOUS SATELLITE Final Report
28 Feb. 1968 326 p refs
(Contract NAS5-10372)
(NASA-CR-100149; RD-2006) Avail: CFSTI CSCL 22B

A detailed feasibility and preliminary design study for the application of a scanning celestial attitude determination system (SCADS) to a synchronous satellite is presented. Two operational modes are considered: a spin stabilized phase in which the synchronous orbit is established from an inclined transfer ellipse, and a three-axis controlled phase in which the synchronous spacecraft is pointed along directions close to local vertical. The mission profile for the ATS F & G program is used as reference. Three SCADS sensor configurations are investigated: a spin mode sensor in which the scan is provided by the vehicle motion, a three-axis mode sensor in which the scan is provided by a synchronous motor, and a dual mode sensor which combines both capabilities in one instrument. With minimum restrictions on the launch window to avoid interference from the sun and moon, it is found that all three configurations are feasible and suitable SCADS designs are evolved. However, it is found that the combination of the two single-purpose sensors gives superior accuracy performance and higher reliability than the dual mode sensor. The approach employing separate SCADS sensors for the two phases is therefore recommended for the ATS F & G missions. Author

N69-19341# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
SATELLITE ATTITUDE STABILITY AND CONTROL
Herve Lory Aug. 1968 85 p refs
(CT-24) Avail: Issuing Activity CSCL 22B

The application of optimal control theory to problems of satellite attitude control is the subject of this report. The background of satellite dynamics is discussed, and the fundamental equations for satellite motion are derived. The effects of perturbation torques and actuation torques on satellite attitude are examined. An analysis of the attitude stability of orbiting satellites deals with the determination of the positions of equilibrium and stability of equilibrium positions of single rigid bodies, rigid bodies with fixed rotating wheels, and single spinning symmetrical bodies. Methods available to control the satellite attitude are reviewed, and the general properties of the solution of typical optimal control problems are discussed in relation to attitude control requirements and constraints. K.W.

N69-19518*# National Aeronautics and Space Administration, Washington, D. C.
GUIDANCE AND NAVIGATION FOR ENTRY VEHICLES
Nov. 1968 47 p refs
(NASA-SP-8015) Avail: CFSTI CSCL 17G

The scope of this document is limited to the atmospheric entry phase of flight for vehicles with maximum L/D ratios less than 1.5. The end of entry is assumed to occur at 100,000 feet for horizontal landing vehicles, and at deployment of the terminal landing system (parachute, paraglider, etc.) for low L/D vehicles. Some discussion of the deorbit maneuver as it affects the entry G&N function is included, but detailed aspects of retrofire for deorbit will be covered in a separate monograph dealing with

thrusting maneuvers in space. The entry G&N system is primarily concerned with the motion of the vehicle center of mass along a desired flightpath. It is closely coupled with the entry stabilization and control (S&C) system which is concerned with vehicle attitude motions about the center of mass. The S&C problem for Earth entry is the subject of another monograph. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N68-18499 Michigan Univ., Ann Arbor.
ENERGY-DEPENDENT NEUTRON TRANSPORT THEORY IN THE FAST DOMAIN
Basil Nicolaenko (Ph.D. Thesis) 1968 233 p
Avail: Univ. Microfilms: HC $10.60/Microfilm $3.05 Order No. 68-13370

Some aspects of the energy-dependent, static neutron transport equation are presented, using a continuous energy formulation (rather than a multigroup scheme). Emphasis is placed on conditions of interest for the high-energy (fast) domain: both fission, inelastic, and elastic slowing-down kernels are included in the analysis. As a first step, focusing on inelastic slowing down problems a synthetic inelastic scattering kernel is studied: such a synthetic operator is separable, but not degenerate. A new energy-transformation is introduced, the application of which yields a particularly simple expression for the Boltzmann equations with inelastic slowing down and without regeneration. Exact solutions of the latter equation are found for various boundary conditions, using Case's method of singular normal modes and inversion formulae for the new energy-transformation. Asymptotic expressions are derived. Dissert. Abstr.

N68-18550 Florida Univ., Gainesville.
A NUCLEAR SPACE PLANE PROPULSION SYSTEM USING GASEOUS AND LIQUEFIED PLANETARY ATMOSPHERES AS A PROPELLANT FOR EXTENDED FLIGHT AND MANEUVERING CAPABILITY
Steven P. D. Smith (Ph.D. Thesis) 1967 212 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 68-9488

This dissertation deals with the theoretical analysis and preliminary design of hybrid vehicles which have nuclear engines and airborne propellant acquisition systems. Such a flight system would have the capability of descending from a planetary orbit into the atmosphere, liquefying some of the constituents of that atmosphere, landing on the surface, taking off and again liquefying some of the atmosphere, and then proceeding back into orbit and maneuvering again from the orbit. Since this sequence can be repeated again and again, this flight system has superior maneuvering capabilities over conventional nuclear and chemical systems. A flight system could function as an aerospace research probe; as a cargo or fuel tanker or a personnel carrier for space stations; as a planetary reconnaissance vehicle; and as an air defense vehicle. The effect of the variations in the atmospheric composition and conditions for the possible nuclear engines are shown. Dissert. Abstr.

N68-18586*# General Electric Co., Idaho Falls, Idaho. Nuclear Systems Programs.
CAVITY REACTOR CRITICAL EXPERIMENT, VOLUME 3
G. D. Pincock and J. F. Kunze 15 Nov. 1968 330 p refs
(Contract C-67747-A)
(NASA-CR-72384; GESP-129-VOL-3) Avail: CFSTI CSCL 18L

This report is volume three of a set covering critical experiments performed on a large cavity reactor system at the National Reactor Testing Station. This volume describes experiments designed to investigate the effects of specific engineering design factors needed for an operating power reactor, and how these factors influence the ultimate critical mass of the system. Included are effects of a linear material to protect the cavity wall from thermal and pressure effects, the hydrogen propellant gas that will occupy the space between this liner and the core, and the appropriate placement of fuel in the reflector in order to reduce the required critical mass in the core. (For Volumes 1 and 2 see N68-11194 and N68-28612.) Author

N68-18957 Florida Univ., Gainesville.
THE APPLICATION OF VOLTERRA SERIES AND NONLINEAR OPERATORS TO NUCLEAR REACTOR KINETICS
Ira Thierer (Ph.D. Thesis) 1967 116 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-9559

The Volterra series solution deals with the system strictly in the time domain and is derived from the integral equation representation of the system. For a given model, it is shown that a reactor with positive feedback at all times can have a range of power levels for which it is absolutely stable. Also, the basic Volterra expansion is vital to the operator analysis method, but is poor for calculating system response. Nonlinear operator analysis yields results in a multi-dimensional transform domain; the appropriate algebra of operators is described and applied to a reactor system. Also, the concept of the multi-dimensional transform is presented. The response of a reactor system is found by a combination of the operator algebra with the transforms. Based on the operator method, some stability criteria are developed for systems with linear feedback. It is found that linear stability is necessary but not sufficient as there are some additional restrictions on both the system and the input to the system when nonlinearities are considered. Based on comparison with simulated system response, the operator method is shown to give results of good accuracy. Dissert. Abstr.

N68-19079*# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
SAVANNAH RIVER LABORATORY ISOTOPIC POWER AND HEAT SOURCES. PART 1: COBALT-60 Quarterly Progress Report, Apr.-Jun. 1968
H. S. Hilborn comp. Jul. 1968 15 p refs
(Contract AT(07-2)-1)
(DP-1169-1-Pt-1) Avail: CFSTI

Diffusion of ^{60}Co in TD Nickel Chromium was significantly slower when perpendicular rather than parallel to the extrusion direction. Oxidation of proposed capsule alloys at 1000°C was proportional to $\sqrt{\text{time}}$ in 10,000-hour tests. Several nickel- and cobalt-based alloys are expected to have adequate oxidation resistance up to 5 years in air. Haynes 25, Hastelloy X, Hastelloy C, and Inconel 600 were selected as capsule materials for the first long-term tests of ^{60}Co capsules at 1000°C. Some of these capsules will have thermocouples with 0.040-in. dia sheaths spot-welded to the surface for accurate capsule temperature measurement. An Inconel 600 capsule containing radioactive cobalt was in satisfactory condition after 10,000 hours at about 900°C. Author (NSA)

N69-19082# Mound Lab., Miamisburg, Ohio.
PLUTONIUM 238 ISOTOPIC FUEL FORM DATA SHEETS Research and Development Report, Period Ending 1 Sep. 1968
S. G. Abrahamson, D. G. Carfagno, and B. R. Kokenge 31 Oct. 1968 86 p refs Supersedes MLM-1441; see N68-19055
(Contract AT(33-1)-GEN-53)
(MLM-1564; MLM-1441) Avail: CFSTI

A compilation of data to Sept. 1, 1968, is presented for isotopic fuel forms of ^{238}Pu which have been studied and for which data have been accumulated at Mound Laboratory. Data were obtained from the open literature and unpublished Mound sources. Since some properties have not been determined for ^{238}Pu, analogous properties of ^{239}Pu are given whenever it could be assumed that these properties were not altered by the isotope or isotopic composition. Whenever ^{239}Pu data are given, this isotope is noted; otherwise data were obtained from ^{238}Pu.
Author (NSA)

N69-19147# United Kingdom Atomic Energy Authority, Harwell (England).
EVALUATION OF THE Pu SUP 239 FISSION CROSS SECTION IN THE ENERGY RANGE 1 keV TO 100 keV
G. D. James and B. H. Patrick Oct. 1968 8 p refs
(AERE-M-2065-Amend; EANDC(UK)-108-AL) Avail: CFSTI; UK 1s 9d

Average values of the ^{239}Pu fission cross section in the energy range 1 to 100 keV were determined over 1-keV intervals below 10 keV and 10-keV intervals above 10 keV by means of a least squares analysis of selected data on the ^{239}Pu and ^{235}U fission cross sections and their ratio. The average error in the mean values over these energy intervals is 5.3%.
Author (NSA)

N69-19157# Eidgenoessiches Institut fur Reaktorforschung, Wurengen (Switzerland).
ANALYSIS OF A STUDY OF SUBMICRON POWDERED MEDIA RELATIVE TO THEIR USE AS THERMAL INSULATORS OF PRESSURE TUBES IN A NUCLEAR REACTOR, SiO_2 POWDERS AND POWDER-FIBER MIXTURES [ESSAI D'ETUDE DES MILIEUX PULVERULENTS SUBMICRONIQUES EN VUE DE LEUR UTILISATION COMME ISOLANTS THERMIQUES DES TUBES DE PRESSION D'UN REACTEUR NUCLEAIRE. POUDRES ET MELANGES POUDRES-FIBER DE SiO_2]
L. Dorra Aug. 1968 125 p refs In FRENCH
(EIR-138) Avail: CFSTI

The various factors affecting the thermal conductivity of powdered materials are reviewed. Effects of choice of material are analyzed, and data on gases produced by heating SiO_2 fiber-powder mixtures are tabulated. Advantages and disadvantages of materials density factors are tabulated. Radiation effects on the thermal conductivity of powdered materials are summarized.
NSA

N69-19178# Atomics International, Canoga Park, Calif.
SOSUM: A PROGRAM TO COMPUTE MULTIGROUP BETA AND GAMMA ENERGY SOURCES FROM RADIOISOTOPE ACTIVITIES
B. J. Dray and R. J. Thomson 3 Jun. 1968 40 p refs
(Contract AT(04-3)-701)
(AD-AEC-M-2693) Avail: CFSTI

The fission-product inventory codes generally used in safety studies compute the isotopic radioactivity in curies or disintegrations/sec. In shielding or heating calculations, the energy sources and spectra are important. The SOSUM code was written to compute multigroup beta and gamma energy sources from radioisotope data. A discussion of the program and its built-in library, general input instructions; and a sample problem are presented. The complete listings for S/360 of the main program and the library are included.
Author (NSA)

N69-19181# Babcock and Wilcox Co., Lynchburg, Va. Nuclear Power Generation Dept.
SODIUM PARAMETER STUDY CODE: NAPS, COMPUTER PROGRAM FOR PARAMETRIC STUDIES OF SODIUM-COOLED FAST BREEDER REACTOR PLANTS
R. A. Crane, A. Mayer, W. R. Cardwell, and S. C. Beers, Jr. Apr. 1968 209 p refs Prepared for Argonne Natl. Lab.
(BAW-1326) Avail: CFSTI

The NAPS computer code (Sodium Parameter Study) has been written to aid in designing sodium-cooled fast reactors. Given the basic independent design parameters, the code determines the core thermal and hydraulic characteristics, structural requirements, nuclear performance, and plant power generation costs. Included in the code are the results of several studies performed to determine fuel fabrication costs, steam plant performance, heat exchanger costs, and nuclear performance. Data from these studies and the design technqiues developed from current sodium technology form the basis of the design model. This design tool has been used in optimizing several preliminary sodium designs, and the results have shown good agreement with those obtained in detailed analyses. NAPS is an especially effective tool for parametric studies of trends in performance and economics that result from perturbations of one parameter.
Author (NSA)

N69-19204# Centre d Etude de l'Energie Nucleaire, Brussels (Belgium).
USE OF PLUTONIUM AS A FUEL IN NUCLEAR REACTORS Quarterly Report, Apr. 1–Jun. 30, 1968
H. Bairiot, comp., A. Lhost, comp., and P. Deramaix, comp. Aug. 1968 87 p refs Transl. into ENGLISH from French
(EURAEC-2065; EUR-4001; QR-18) Avail: CFSTI

Topics discussed include: fabrication of PuO_2–UO_2 fuel rods by vibratory compaction; assaying Cl by spectrophotometry; and neutron radiation effects on Zircaloy 2-clad and Type 304 stainless steel-clad rods of PuO_2–UO_2.
NSA

N69-19205# Brookhaven National Lab., Upton, N. Y. Radiation Div.
SAFETY REVIEW OF THE BROOKHAVEN CHEMONUCLEAR IN-PILE RESEARCH LOOP
M. Steinberg, W. Tucker, C. Waide, M. Beller, P. Bezler et al Oct. 1968 72 p refs
(BNL-13001) Avail: CFSTI

The Chemonuclear In-Pile Research Loop installed in the Brookhaven Graphite Research Reactor is a facility for investigating chemonuclear reactions under flow conditions. It is designed to handle gaseous systems in conjunction with packages of solid fixed fuel. The facility design, operation and research program, and hazards analysis are described.
NSA

N69-19208# Babcock and Wilcox Co., Lynchburg, Va. Research and Development Div.
EXAMINATION OF FAST REACTOR FUELS Final Technical Report, Apr. 17–Jun. 30, 1968
D. H. Schmitt Aug. 1968 120 p refs
(Contract AT(30-1)-3968)
(BAW-3968-1) Avail: CFSTI

In order to determine the capabilities of the Babcock & Wilcox analytical laboratory to characterize FFTF fuels, sintered PuO_2–UO_2 pellets were obtained from the Pacific Northwest Laboratory (PNL). This characterization required the development and standardization of several analytical methods. Results were obtained for the following measurements: assay for uranium and plutonium; isotopic assay; gas evolution; density; and homogeneity and solid solution.
Author (NSA)

N69-19219# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Radiochemie.
METHOD FOR CHEMICAL ANALYTICAL DETERMINATION OF PLUTONIUM AND URANIUM IN OXIDIC NUCLEAR FUELS
L. Lindner and A. von Baeckmann [1968] 43 p refs Transl. into ENGLISH of German Rept. KFK-701
(EURFNR-525; EUR-3714d) Avail: CFSTI

Procedures for the chemical determination of Pu and U in oxidized fuel which have been used for routine analysis for more than a year are described. For each method, the principle of the determination, the step-by-step procedure, and the possible interferences are described. The methods given are the dissolution of PuO_2 and PuO_2/UO_2, oxidimetric determination of U in phosphoric acid medium, cerimetric determination of equivalent amounts of U and Pu, cerimetric determination of Pu in addition to U and Fe, coulometric determination of Pu on the potential-controlled electrode, gravimetric determination of Pu in PuO_2, factor determination of the Ce(IV) sulfate solution with sodium oxalate, and preparation of a U/Pu solution for routine control. The reproducibility and validity of the methods are discussed. NSA

N69-19229# Oak Ridge National Lab., Tenn.
DIFFUSION PROCESS FOR REMOVING TRITIUM FROM THE BLANKET OF A THERMONUCLEAR REACTOR
A. P. Fraas Dec. 1968 24 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-2358) Avail: CFSTI

The tritium concentration in the blanket of a thermonuclear reactor is important both from the standpoint of its effect on the capital investment required and from the standpoint of possible embrittlement of the structural material. The size and cost of the system required to keep the tritium concentration to an acceptable level are important from the feasibility standpoint. The high diffusion coefficient for H diffusing through Nb makes it possible to design a tritium removal system for thermonuclear reactors. The proposed system entails tritium diffusion from the Li of the blanket as it circulates through the main heat exchangers built of Nb. These would be operated at about 1800°F and be used to boil potassium for a potassium vapor topping cycle. A stainless steel potassium condenser operating at about 1100°F would serve not only as the boiler for a steam cycle but it would also be designed to concentrate the tritium which would be drawn off as a noncondensable. Author (NSA)

N69-19315# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
REACTOR PHYSICS DEPARTMENT TECHNICAL ACTIVITIES Quarterly Report, Apr.-Jun. 1968
Nov. 1968 115 p refs
(Contract AT(45-1)-1830)
(BNWL-887) Avail: CFSTI

Topics discussed include: aluminum alloys and systems; criticality studies; core physics of nuclear reactors; plutonium fuel systems; plutonium alloys; plutonium recycle critical facility; plutonium recycle test reactor; reactor control elements; and reactor fuel elements. NSA

N69-19382# New Mexico Univ., Albuquerque. Bureau of Engineering Research.
MODERN CONTROL ASPECTS OF NUCLEAR REACTORS Final Report
J. Phelan, H. K. Knudsen, and R. R. Mohler Jul. 1968 58 p refs Prepared for Sandia Corp.
(Contract AT(29-1)-789)
(SC-CR-68-3739; EE-157) Avail: CFSTI

Optimal control and the synthesis of practical suboptimal controls for reactors were investigated. A quasi-linear programming algorithm was developed to solve problems involving constraints in state and control by a sequence of linear programming solutions. The system is put into the realm of linear programming problems by a set of difference equations and a linearization procedure. The design of suboptimal controllers was examined by development of the concept of constant quality surfaces in state space. System controllability was investigated by a derivation of the reachable states for a reactivity-constrained two-dimensional system. Controllability of bilinear systems was also examined. A Popov stability analysis was used to extend a frequency response for a linearized reactor control system to include certain time-invariant nonlinearizations such as appear in control actuators. The computation of optimal controls for a nuclear rocket reactor is included in the appendix. NSA

N69-19353# Kyoto Univ. (Japan). Research Reactor Inst.
REPORTS TO COMMITTEE ON REACTOR PHYSICS RESEARCH BY PULSED NEUTRONS IN FISCAL 1968
1967 91 p refs In JAPANESE
(KURRI-TR-40) Avail: CFSTI

The 14 reports presented at the meetings are given in the form of short articles dealing with the 20-m time-of-flight neutron analyzer at KURRI, the KURRI neutron generator and preliminary time-of-flight experiments, research program with the linear accelerator, differential neutron spectra by time-of-flight in JAERI, eigenvalues in neutron wave transmission, neutron measuring techniques, fast reactor neutron spectra, data analysis in neutron spectroscopy, pulse-shape discrimination in stilbene scintillator, thermal neutron scattering in moderators, pulse experiments in light water and natural uranium system, etc. NSA

N69-19492# Sandia Corp., Albuquerque, N. Mex. Aerospace Nuclear Study Dept.
THE AERIAL DETECTION OF Co-60 FUELED RADIOISOTOPE THERMOELECTRIC GENERATORS
R. J. Everett Sep. 1968 17 p refs
(Contract AT(29-1)-789)
(SC-TM-68-627) Avail: CFSTI

The aerial detection of a hypothetical ^{60}Co radioisotope thermoelectric generator is discussed for the ground level and earth and water penetration cases. A knowledge of ^{60}Co radiation fields and minimum detection levels of gamma counting equipment allowed an estimation of the detection altitude as a function of source size. Similar plots were constructed for the earth and water penetration case, using reported values for absorption and radiation buildup. Actual detection of ^{60}Co sources in the past allowed a comparison with theoretical predictions. Author (NSA)

N69-19564# Mound Lab., Miamisburg, Ohio.
POLONIUM-210 ISOTOPIC FUEL FORM DATA SHEETS
S. G. Abrahamson, comp., L. K. Matson, comp., and W. E. Strickland, comp. 31 Oct. 1968 33 p refs Supersedes MLM-1441
(Contract AT(33-1)-GEN-53)
(MLM-1563; MLM-1441) Avail: CFSTI

This report presents a compilation of data for isotopic fuel forms of polonium 210 which have been studied and for which data have been accumulated. Data were obtained from the open literature and unpublished sources. Since some properties have not been determined for polonium 210, data from elements in the same family as polonium, e.g., tellurium, selenium or sulfur, and from compounds analogous to the polonium compounds, e.g., gadolinium telluride, were given wherever it could be assumed that these properties are similar to the desired polonium fuel form. Similarly, since polonium 210 has a short half life resulting in an appreciable buildup of lead 206 within a relatively short time, properties of lead are included when pertinent. Analogous data for isotopic fuel form of plutonium 238 are published in MLM-1564. Author

N69-19588# Oak Ridge National Lab., Tenn.
EXPERIMENTAL INVESTIGATION OF HFIR FUEL PLATE DEFLECTIONS INDUCED BY TEMPERATURE AND PRESSURE DIFFERENTIALS
R. D. Cheverton and W. H. Kelley 16 Aug. 1968 59 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-2325) Avail: CFSTI

Fuel plate deflections in the High Flux Isotope Reactor fuel element have been investigated experimentally by subjecting a single plate to thermally induced displacements and to pressure differentials. Of particular interest were the plate's mechanical stability characteristics when subjected to longitudinal loading along the two edges of the plate, a condition that is encountered when a temperature difference exists between the fuel plate and side plate. The results of the experiments indicate that under HFIR operating conditions the fuel plates will always deflect toward the convex side of the involute over the central portion of the plate and toward the concave side close to the ends. A plate was also subjected to a differential strain almost three times as great and a temperature 200°F higher than expected in HFIR; the same deflection characteristics were observed. In neither case was there any indication that the plate had buckled longitudinally, that is, that the critical load had been achieved. Pressure deflections were found to be the same as predicted with calculations. Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N69-18435 Rockefeller Univ., N. Y.
PHYSICS, MOLECULAR: ON THE THEORY OF SOUND PROPAGATION IN MONATOMIC GASES AND BINARY MIXTURES
James Dennis Foch, Jr. (Ph.D. Thesis) 1967 150 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-9582

A microscopic theory of sound propagation is developed from the linearized Boltzmann equation, and is shown to include and generalize the known macroscopic or hydrodynamic theories (Navier–Stokes and Burnett). The principal theoretical result, based on calculations for the inverse power and Lennard–Jones potentials, is that the dispersion law is nearly universal when expressed in terms of suitable reduced quantities. A microscopic theory of sound propagation is developed from the coupled, linearized Boltzmann equations. Again the microscopic theory is shown to include and generalize the known macroscopic theory. The principal theoretical result for mixtures is that the initial frequency dependence of the sound velocity varies strongly with mole fraction in certain mixtures. Dissert. Abstr.

N69-18457 Cornell Univ., Ithaca, N. Y.
ACOUSTIC ATTENUATION IN POTASSIUM CHLORIDE AND POTASSIUM CHLORIDE LITHIUM ION IN THE KILOMEGACYCLE RANGE
Raymond Ping Auyang (Ph.D. Thesis) 1968 79 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-9672

The ultrasonic attenuation in KCl and KCl containing Li^+ impurities was measured in the frequency range of 500 Mc/sec to 1745 Mc/sec at temperatures from 1.7 to 30°K. After subtracting the low temperature background, all the attenuation constants of the pure modes in KCl were found to vary as T^4 except the <111> shear mode and the <110> shear mode with a <110> polarization. For these two shear modes, the temperature variations are slower and not expressible as a single power of the temperature. A linear frequency dependence was observed for all the longitudinal modes in KCl. The absolute values and variations with type of mode agree qualitatively but not quantitatively with the theoretical values. The value for the <100> shear is two orders of magnitude higher than that calculated for phonons with infinite life time; the agreement between experiment and theory is much better if relaxation of phonons (finite life time) also for the transverse modes is taken into account. Dissert. Abstr.

N69-18460 Tennessee Univ., Knoxville.
REFLECTION AND SUBSEQUENT PROPAGATION OF A FINITE AMPLITUDE ULTRASONIC WAVE
Arnie Lee Van Buren (Ph.D. Thesis) 1967 139 p
Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-9837

When an ultrasonic wave is reflected from an interface, a phase shift which is dependent on the angle of incidence occurs. If the wave is of finite amplitude, this phase shift causes relative spatial shifting of the Fourier harmonic components. A model which assumes independent reflection of the Fourier components is used to determine the resulting unstable wave shape. The phase shift upon reflection of a specific Fourier component is derived from linear theory. The phases and amplitudes of the re-synthesized components are calculated for different distances of propagation of the wave after reflection. An experimental technique is developed to measure the amplitudes and phases of the first two Fourier components in the reflected wave. The results of these measurements are found to be in good agreement with the theoretical results. Dissert. Abstr.

N69-18468 Tennessee Univ., Knoxville.
SOLUTIONS TO ELECTROMAGNETIC INDUCTION PROBLEMS
Caius Vernon Dodd (Ph.D. Thesis) 1967 90 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-9798

Methods are described of solving electromagnetic induction problems by use of the vector potential. The differential equations for the vector potential are derived from Maxwell's equations, and cylindrical symmetry is assumed. This differential equation is then solved by two different basic techniques: a "closed form" solution and a relaxation solution. For the "closed form" solution, sinusoidal driving currents and linear, isotropic, and homogeneous media are assumed. The differential equation is solved for two different conductor configurations. The relaxation method is used for three different cases of applied currents; and finite difference approximations are made for all terms in the differential equation; the vector potential at every point is expressed in terms of the vector potential at neighboring points. The vector potential at every point may then be solved using a relaxation (iteration) technique for any particular configuration of coil and material. Once the vector potential is determined, any physically observable electromagnetic phenomenon can be calculated from it. Examples of the application of the relaxation technique to solve these problems and experimental verification of the answers are given. In most cases the agreement between calculated and measured values is good. These two techniques will allow the solution of a large number of electromagnetic induction problems. Dissert. Abstr.

N69-18532 University of Southern Calif., Los Angeles.
OPTICAL AND PHOTOELECTRIC PROPERTIES OF GOLD AND ALUMINUM IN THE EXTREME ULTRAVIOLET
Arthur Lyle Morse (Ph.D. Thesis) 1968 98 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-12050

The optical and photoelectric properties of thin films of gold and aluminum have been investigated in the spectral region of 100 to 1000Å. Particular attention has been paid to the effects of polarization and angle of incidence on the total yield and energy distribution of the photoelectrons. The reflectance, which was measured as an essentially continuous function of the angle of incidence in order to obtain yields per absorbed photon, was also used in conjunction with the Fresnel relations to calculate the optical constants and polarization of the incident beam. To check these results, the polarization was measured directly, and in addition the reflectance was measured at several angles of incidence with the plane of incidence rotated 90°. The calculated optical constants and the complementary polarization data were then used to predict the original reflectance curves. Dissert. Abstr.

N69-18564 California Univ., Berkeley.
OPTICAL PUMPING IN ATOMIC LEAD
Berken Chang (Ph.D. Thesis) 1967 116 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Ordering No. 68-10296

The optical orientation of the nucleus in the $6s^26p^2\ ^3P_0$ ground state of lead-207 is attempted. Light sources with differing ratios of hyperfine intensities are evaluated to determine their contribution. These sources, in particular a pressure-shifted hyperfine-absorption filter and a self-reversed lead-208 lamp, are studied spectroscopically and then used for pumping. Optical pumping rate equations are used to estimate the signal to noise as a function of R, the ratio of the hyperfine intensities and k, the mixing parameter. Radioisotope lead lamps are also developed for use in future pumping of lead-205 or -203. A detection system is developed which has sufficient sensitivity to detect a signal when the relaxation time is greater than 10 msec. No signal is seen in cells without a buffer gas, with 10 torr of He buffer, and with 100 torr of He buffer. The shortness of the deduced relaxation time for an unbuffered cell is partially explained by the length of the cell wall adsorption time of the lead atom. The shortness of the relaxation time when using a helium buffer is surprising and suggests that the ground state of the Pb may not be spherically symmetric on buffer gas collisions. Dissert. Abstr.

N69-19042 California Univ., Riverside.
EFFECT OF A UNIFORM ELECTRIC FIELD UPON OPTICAL ABSORPTION OF GALLIUM ARSENIDE
Barry Travers French (Ph.D. Thesis) 1967 158 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-9754

The electric field induced shift in the optical transmission of semi-insulating gallium arsenide has been measured for photon energies from 1.4 to 2.0 electron volts. Electric fields up to 10^5 volts cm^{-1} were applied to samples ranging from 3.36 to 37 microns in thickness. Uniform fields were obtained by applying 10 to 50 microsecond square voltage pulses across the specimen at a rate of 500 p.p.s. A cooled photomultiplier and a synchronous detector were utilized to permit transmission shifts of 5×10^{-3} to be observed with .001 ev resolution. The transmission shift was measured at 25°K and 90°K. In conjunction with zero field optical absorption coefficient measurements, the absorption coefficient shift as a function of electric field has been obtained. At energies below the experimentally observed edge (1.496 ev at 90°K, 1.503 ev at 25°K) the absorption falls almost exponentially. Dissert. Abstr.

N69-19074# Joint Publications Research Service, Washington, D. C.
TAU-MEASUREMENTS OF RELAXATION PROCESSES WITH A "JUMP"
N. A. Tolstoy et al 10 Feb. 1969 5 p refs Transl. into ENGLISH from Zh. Prikl. Spectry. (Moscow), no. 6, Dec. 1966 p 756–758 (JPRS-47414) Avail: CFSTI

The study of relaxation luminescence characteristics has become one of the standard methods of spectroscopic investigation of matter; the development of work in the field of optical generation makes relaxation measurements especially urgent. Therefore, every improvement and perfection of relaxation methods of research is desirable and useful. Author

N69-19111# Southwest Research Inst., San Antonio, Tex.
SCATTERING OF STRESS WAVES BY MULTIPLE CIRCULAR CYLINDRICAL ELASTIC OBSTACLES EMBEDDED IN AN ELASTIC MEDIUM
William L. Ko Aug. 1968 74 p refs
(TR-1) Avail: Issuing Activity

Interaction between a plane compressional pulse stress wave and a row of circular cylindrical obstacles is investigated. All the wave scattering objects are uniform in size and have identical elastic properties dissimilar to those of the surrounding unbounded medium. The axes of the cylinders lie in a plane perpendicular to the incident propagation vector. Using Kirchhoff's method of retarded potentials, formal solutions are obtained for the response at a typical obstacle boundary, in its interior and in the exterior field due to the first generation interaction. The solutions are valid for the whole spectrum of elastic properties of the obstacles ranging from rigid bodies to voids. Applicability of the result to some other wave scattering phenomena is demonstrated by two examples: (1) interaction of stress waves in two-dimensional wedges and (2) attentuation of stress waves in multiply laminated composites. Author

N69-19185*# Columbia Univ., New York. Radiation Lab.
RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM Progress Report, 1 May–31 Oct. 1968
V. M. Bennett and S. R. Hartmann, ed. 31 Oct. 1968 69 p refs
(Grants NGR-33-008-009; NGR-33-008-012; NGR-33-008-102; Contracts DA-28-043-AMC-00099(E); DA-31-124-ARO(D)-305 et al
(NASA-CR-100017; PR-18) Avail: CFSTI CSCL 20F

The spectral distribution of the two-photon emission from the metastable $2^2S_{1/2}$ state of singly ionized helium has been verified. Two-photon coincidence counting rates were observed experimentally and agree with those calculated from the theoretically predicted spectral distribution of the two-photon emission. In addition, radiation due to the impact of low-energy metastable singly ionized helium on helium and on the other rare gases has been detected. An rf resonance experiment has been initiated to make a high precision determination of the fine-structure intervals and the quadrupole coupling constant of the $(1s2s2p)^4P^0$ metastable autoionizing state of lithium. A summary is given of the current status of the experimental work. Intensity modulation of light at the 6.835 GHz hyperfine frequency of Rb^{87} and a magnetic rotation spectrum of molecular cesium have been observed for the first time. A partial rotational analysis of the (1,0) band of the 7500-Å band system of Cs_2 gives a value of 0.00104 cm^{-1} for $B''-B'$ Author

N69-19312# National Research Council of Canada, Ottawa (Ontario).
EXPERIMENTAL RESULTS OF THE DETERMINATION OF PERMITTIVITY BY THE METHOD OF EXTRAPOLATION TO THE INFINITE THICKNESS OF THE SPECIMEN [EXPERIMENTALNE VYSLEDKY STANOVENIA PERMITTIVITY METODOU EXTRAPOLACIE NA NEKONECNU HRUBKU VZORKY]
Jan Vilim 1968 21 p refs Transl. into ENGLISH from Elektrotech. Casopis (Bratislava), v. 18, no. 8, 1967 p 597–614 (NRC-TT-1350) Avail: CFSTI

This article gives a more comprehensive account of the experimental verification of an original method of determining the permittivity of solid linear dielectrices by extrapolation to the infinite thickness of the specimen. The results are not affected by the systematic error caused by the different types of electrodes used, nor by the systematic error in the measurement of specimen thickness. The measured results were statistically processed. On an average, a precision of about 1%, expressed by an estimation of the standard error, was achieved. In the best case, it was 0.1%. Author

N69-19395#
PROPAGATION OF A LIGHT PULSE IN A SEMI-INFINITE ISOTROPICALLY SCATTERING MEDIUM
I. L. Katsev 1968 8 p refs Transl. into ENGLISH from Zh. Prikl. Spektr. (Minsk), v. 9, no. 6, 1968 p 969–976
Avail: CFSTI

A nonstationary transport equation in a two flux approximation is solved for a semi-infinite isotropically scattering medium exposed to an instantaneous light pulse along the normal to the surface. The approximate formulas obtained, which describe the scattered light intensity at different optical depths for different angles of observation as a function of the time, can be used for numerical computation. B.P.

N69-19439# National Research Council of Canada, Ottawa (Ontario).
METHOD OF DETERMINATION OF DIELECTRIC CONSTANT WITH THE ELIMINATION OF THE DISTURBING INFLUENCES OF THE ELECTRODES AND THE SURFACE OF THE DIELECTRIC SPECIMEN
Jan Vilim 1968 12 p refs Transl. into ENGLISH from Electrotech. Obzor (USSR), v. 54, no. 10, 1965 p 486–490
(NRC-TT-1349) Avail: CFSTI

The measured value of dielectric constant of materials depends upon the type of measuring electrodes used, the uniformity of specimen surface, as well as some physical properties of materials. The influences of these factors decrease as specimen thickness increases. It was proven experimentally that two parameters can express the dependence of the dielectric constant on specimen thickness. Therefore, it was sufficient to perform two measurements, using a uniform type of electrode on specimens of uniform material of two different thicknesses, the kind in which the distorting, disturbing influence in the zone of the electrode specimen interface is not hidden by errors in measurement. An effective disturbing thickness is one parameter of dependence. Another is the real value of the dielectric constant of the material. These parameters may be numerically determined from two measurements. Results showed that the disturbing influence in the zone of the electrode and specimen surface cannot be ignored, even where relatively large specimen thicknesses are involved. With decreasing thickness, the influence increases and the error in determining the dielectric constant may greatly exceed the tolerance. Author

N69-19489#
MULTIPLE LIGHT SCATTERING IN A SEMI-INFINITE MEDIUM
D. I. Nagirner [1968] 14 p refs Transl. into ENGLISH from Tr. Leningr. Astron. Observ. (USSR), v. 25, 1968 p 3–17
Avail: CFSTI

An analysis of the theory of multiple scattering of radiation is presented. Special functions which permit the determination of the radiation field, and the excitation of the medium are investigated. These functions and their properties are considered in the following areas: (1) resolvent of the fundamental equation, (2) the function H(Z,λ), (3) homogeneous equations, (4) light scattering with frequency distribution, and (5) asymptotic formulas. F.O.S.

N69-19542 National Lending Library for Science and Technology, Boston Spa (England).
ANALYSIS MAGNETOTHERMAL EFFECTS
K. Kraus Dec. 1968 20 p refs Transl. into ENGLISH from Casopis Pestovani Mat. Fys., v. 14, no. 1, 1964 p 5–16
(NLL-RTS-4882) Avail: Natl. Lending Library, Boston Spa, Engl. 30s

An analysis of the theories concerning magnetothermal effects is presented. Two theories are investigated: the Stoner–Rhodes and the Teale–Rowlands. This analysis is based on the domain theory of ferromagnetic materials in which a change in the magnetization is due to three processes: a change in the value of spontaneous magnetization, translational motion of the domain walls, and rotation of the vectors of spontaneous magnetization. The study indicates that neither of these theories leads to a separation of reversible and irreversible processes. It is considered that some improvement might be made by an evaluation of the individual processes from the point of view of the energy changes characterizing the process in direct connection with the hysteresis loop. F.O.S.

N69-19543 National Lending Library for Science and Technology, Boston Spa (England).
DETERMINING LUMINOSITY IN TERMS OF THRESHOLD INCREMENTS [OPREDELENIE SVETLOTY METODOM POROGOVYKH PRIRASHCHENII]
A. B. Matveev et al Jul. 1968 9 p refs Transl. into ENGLISH from Svetotekhnika (Moscow), v. 11, no. 12, 1965 p 10–14
(NLL-LC-1428-(5198)) Avail: Natl. Lending Library, Boston Spa, Engl.

Experiments were conducted to determine the relationship of threshold differences of luminance as a function of the object brightness against different backgound luminances. On a screen .45 meters from the observer a background luminance was created using two light sources. Adjustment of the luminance was effected by changing the distance between light sources and screen, and by lamps of different power. Through an aperture in the center of the screen the observer saw with binocular vision the surface of a white plate. The luminance of this plate was determined by light from a mirror lamp, and by neutral latticed filters. Against this background the observer had to see a square object, and was required to identify differences in luminance in the background. Charts showing results of comparison scales of luminosity are included. F.O.S.

N69-19560 Boeing Co., Seattle, Wash. Commercial Airplane Div.
DEVELOPMENT AND VALIDITY OF THE NOISE UNIT CALLED EFFECTIVE PERCEIVED NOISE LEVEL
15 Jan. 1968 66 p refs
Avail: Issuing Activity

Developed is a method for combining received aircraft noise levels with tone and duration corrections in order to establish a noise certification measurement unit. The procedure is based on a manageable engineering statement and experimental data in support of a combined tone and duration concept. Test results indicate that a proven method for evaluating subjective effects of sound duration do not exist and that the magnitude of the duration effects is strongly affected by the test environment. Current duration factors applied to aircraft noise range from 4.5 decibels/double duration to 3 db/DD. G.G.

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N69-18330 Kansas State Univ., Manhattan.
INVARIANT IMBEDDING THEORY OF PHOTON TRANSPORT
Richard Edward Kaiser (Ph.D. Thesis) 1968 168 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-9911

The method of invariant imbedding was applied to the problem of photon transport in the derivation of the differential equations for reflection and transmission functions. The geometry considered was a homogenous slab, infinite in the y and z directions and finite or semi-infinite in the x direction. Incident energies in the range 0.1 to 10 MeV were considered, with the emphasis on the range above 1.022 MeV where pair production occurs. The source was considered to be an imfinite plane. The reflection and transmission functions were broken down into scatter and pair production components, and each of these was then segmented further as to whether the emerging photon is uncollided, singly scattered or multiply scattered. Uncollided transmission and single scatter transmission and reflection problems were then solved analytically. A multigroup structure was used to represent the energy dependence and a shifted Gaussian quadrature to represent the angular dipendence for values of cosine theta from −1 to 0 or from 0 to 1. Dissert. Abstr.

N69-18431 Rochester Univ., N. Y.
PHYSICS, NUCLEAR: A MEASUREMENT OF THE CROSS SECTION AND POLARIZATION IN PROTON-DEUTERON ELASTIC SCATTERING AT 198 MeV
Rexford Earle Adelberger (Ph.D. Thesis) 1968 115 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-9352

This experiment was a simultaneous measurement of the proton–deuteron elastic differential cross section and polarization at an incident energy of 198 ± 2 MeV over an angular range of 80 degrees to 170 degrees in the center of mass. The relative errors on the cross section were 3 to 4 percent and the polarization was measured to ± 0.01. A liquid deuterium target was bombarded with a polarized proton beam and the mass of the scattered particles determined. An elastic event was identified by the detection of a deuteron. The mass determination was done using a two dimensional energy, time of flight analysis of the scattered particles. A PDP-8 computer was used on line to do this analysis. The polarization was measured rotating the spin of the beam from the vertical plane to the horizontal plane with a solenoid magnet, and by detecting the particles that scattered up and down. By reversing the direction of the magnet field in the solenoid, the polarization of the beam could be flipped 180 degrees in the horizontal plane, providing a measurement of polarization in which alignment errors cancelled to first order. Dissert. Abstr

N69-18432 Washington Univ., Seattle.
STUDIES OF PROTON SPIN FLIP IN INELASTIC SCATTERING FROM CARBON AND NICKEL ISOTOPES
Wojciech Adam Kolasinski (Ph.D. Thesis) 1967 108 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-9299

The probability for proton spin flip has been measured in the reactions $C^{12}(p,p')C^{12*}(4.43)$ at 12, 13, 14, and 15 MeV, $Ni^{58}(p,p')Ni^{58*}(1.45)$ at 9.25, 10.46, and 15.0 MeV, and $Ni^{60}(p,p')Ni^{60*}(1.33)$ $Ni^{64}(p,p')Ni^{64*}(1.34)$ at 10.5 and 14 MeV. Use was made of the technique in which the inelastically scattered protons are detected in coincidence with deexcitation gamma rays emitted along the direction perpendicular to the scattering plane. The transitions which were investigated are of the type $0^+ \rightarrow 2^+ \rightarrow 0^+$, and in these cases, gamma rays are emitted along the reaction plane normal only if spin flip occurs. A theoretical analysis of the results was carried out, using the collective extension of the optical model with a spin orbit interaction. Agreement with the carbon data is very poor. In the case of the nickel isotopes, better agreement is obtained. The calculations show that in order to reproduce the observed forward peak in the spin-flip probability, it is necessary to introduce a deformation in the spin-orbit potential which is approximately twice the deformation in the ordinary potential. Dissert. Abstr.

N69-18434 Washington Univ., Seattle.
SCATTERING OF POSITIVE AND NEGATIVE MUONS FROM ELECTRONS AT ENERGIES AROUND 6 GeV AND 11 GeV
Thomas Bernard Walter Kirk (Ph.D. Thesis) 1967 128 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-9297

The scattering of positive and negative high energy muons from electrons has been measured and compared. An electromagnetic shower counter was employed in determining the scattered electron energy. The laboratory energy transfer to the electron varied from 100 MeV to 6.5 GeV. In this range no asymmetry was observed within the ± 10% experimental resolution. The theoretical μ-e cross sections (without radiative corrections) were verified to an accuracy of ± 30%. A systematic uncertainty in calibrating the shower counter energy response precluded a check of the radiative corrections (estimated to be 10–20%). Dissert. Abstr.

N69-18436 Princeton Univ., N. J.
THE SPINS AND MAGNETIC DIPOLE MOMENTS OF K 45 AND Sb 12C
Geoffrey Jeremiah Garrett (Ph.D. Thesis) 1968 91 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-9678

Spins and hyperfine structures have been determined for 20-min K^{45} and 16-min Sb^{120} by the atomic beam magnetic resonance method. The experiments utilized the resonance apparatus which is on line with the external beam of the Princeton cyclotron. The isotopes were produced by the reactions $Ca^{48}(p,\alpha)K^{45}$ and $Sn^{120}(p,n)Sb^{120}$ on isotopically enriched targets in an 0.3 μA beam of 17.5-MeV protons. The values of the spins and hyperfine structure constants are $I(K^{45}) = 3/2$, $I(Sb^{120}) = 1$, $|a(K^{45})| = 102.2936(7)$ Mc/sec, and $|a(Sb^{120})| = 520(47)$ Mc/sec. From these values the nuclear magnetic dipole moments are calculated to be $|\mu_I(K^{45})| = 0.1734(10)$nm and $|\mu_I(Sb^{120})| = 2.34(22)$ nm (diamagnetically corrected). The measured moments are in good agreement with predictions based on the configuration $(1d^{-1}{}_{3/2})_P$ $(1f^{-2}{}_{7/2})_N$ for K^{45} and the configuration $(2d^{1}{}_{5/2})_P$ $(2d^{-1}{}_{3/2})_N$ for Sb^{120}. Dissert. Abstr.

N69-18437 California Univ., Riverside.
GEOMETRIC APPROACH TO LOCAL GAUGE THEORY
Richard Perry Treat (Ph.D. Thesis) 1967 100 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-9764

It is shown that the free Yang–Mills equations admit as an exact solution a non-Maxwellian field, singular on a world line, with short range components which arise from the nonlinearities of the field equations. The electric charge is identified as the asymptotic field, in contradistinction to the algebraic identification which is customary in gauge theory. It is shown that free Yang–Mills fields have a positive definite energy density if the internal holonomy group is semi-simple and compact. Gauge potentials acting in the linear vector space formed by the six generators $L_{\mu\nu}{}^{\lambda}(x^{\mu})$ of local Lorentz transformations have been considered. This algebra space is identified as the internal space associated with the internal degrees of freedom of elementary particles. A link between the internal space and the event space is established through the $L_{\mu\nu}{}^{\lambda}(x^{\mu})$: it is similar to the link that exists between the Dirac spin space and the event space through the Dirac operators. Dissert. Abstr.

N69-18454 Pennsylvania Univ., Philadelphia.
THE Ne 22(He 3, α)Ne 21, Mg 24(He 3, α)Mg 23, AND Mg 26(He 3, α)Mg 25 REACTIONS AT 15 MeV
James Martin Joyce (Ph.D. Thesis) 1967 95 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-9210

The (He^3, α) reaction was studied on the nuclei Ne^{22}, Mg^{24}, and Mg^{26}. Of interest were the states excited in the residual nuclei Ne^{21}, Mg^{23}, and Mg^{25} and the structure of the ground states of the target nuclei. The Ne^{22} target consisted of a reciprocating gas cell filled to a pressure of 2.5 psi with isotopically enriched Ne^{22}. The Mg^{24} target was an isotopically enriched foil vacuum evaporated on a carbon backing. The Mg^{26} target was a vacuum evaporated self-supporting foil of isotopically enriched Mg^{26}. An array of up to eight silicon surface barrier detectors was used to measure the angular distributions of the elastically scattered He^3 particles and of the reaction alpha particles in a 61 cm. diameter scattering chamber. The He^3 elastic scattering angular distributions were analyzed with an optical model search code. The angular distributions of the alpha particles leaving the residual nuclei in their ground and low-lying excited states were compared to those predicted by distorted wave Born approximation calculations. Dissert. Abstr.

N69-18455 Rochester Univ., N. Y.
THE INTERNAL SYMMETRY GROUP SU-3 x SU-3 WITH MINIMAL EXTENSIONS PARITY AND CHARGE CONJUGATION APPLIED TO STRONG MESON DECAY
William Preston Moran (Ph.D. Thesis) 1968 217 p
Avail: Univ. Microfilms: HC $9.90/Microfilm $3.00 Order No. 68-9389

An internal symmetry group $W_3(SW_3)$ containing the continuous group SU_3 and the discrete operators parity and charge conjugation is applied to the strongly interacting mesons and meson resonances. After defining the connection of the discrete operators to the internal symmetry as a minimal extension, the structure of such an extension is explored, and its intimate connection to the three-field model with parity interchanges is displayed. The meson spectrum is examined to test the ability of the symmetry to classify particles. Information on the masses and decays of massive meson resonances is reviewed and extended on very general phenomenological grounds. It is essential to the tests of the group W_3 (SW_3) to have as much information as possible about states of the same spin but different P and C. Dissert. Abstr.

N69-18456 Colorado Univ., Boulder.
POLARIZATION OF 40 MeV He 3 IONS ELASTICALLY SCATTERED FROM C 12
Richard Lee Hutson (Ph.D. Thesis) 1967 128 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-10619

Elastic scattering cross sections for 36 and 42 MeV ^{3}He ions scattered from ^{12}C were measured and a double-scattering asymmetry measurement was performed in which ^{3}He ions were scattered from ^{12}C. The average energy was 41 and 36 MeV at the two targets. On the basis of an optical model analysis of the data it was concluded that a spin-orbit strength of 6 MeV, approximately equal to the spin-orbit strength for nucleons, is inconsistent with the measurements for ^{3}He scattering. A maximum probable value of about 3.5 MeV, based on the measured asymmetry plus one standard deviation, was estimated for the case of ^{3}He scattering from ^{12}C around 40 MeV. The results of the measurements and analysis were consistent with theoretical calculations of 1.67 MeV for the spin-orbit potential. Dissert. Abstr.

N69-18461 Tennessee Univ., Knoxville.
A V* IMPROTANCE FUNCTION FOR THE MONTE CARLO CALCULATION OF THE DEEP PENETRATION OF GAMMA RAYS
Tony Wray Armstrong (Ph.D. Thesis) 1967 103 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-9787

The successful application of the Monte Carlo method to problems involving the deep penetration of radiation requires the specification of an appropriate importance function which will identify those regions of the phase space that contribute most heavily to the answer of interest. An importance function based on the first term (the V* term) of the series representation of the value (or adjoint) function is formulated and evaluated. For the case of 1 MeV gamma rays incident normally on thick homogeneous slabs of lead and water, it was demonstrated that this V* importance sampling scheme provides considerable improvement over the conventional exponential transform method. For the same computation times, the variance of the dose buildup factor at 21 m.f.p. was reduced by factors of about 125 and 50 for lead and water, respectively. For the particular source-geometry configuration investigated, the improvement was found to be contributed approximately equally by the spatial and polar angle biasing with essentially no improvement provided by the axiumthal angle biasing. Dissert. Abstr.

N69-18463 Princeton Univ., N. J.
ON INSTABILITIES ASSOCIATED WITH THE INTERACTION OF RELATIVISTIC ELECTRONS WITH ELECTROSTATIC WAVES PROPAGATING NEARLY PERPENDICULAR TO A STATIC MAGNETIC FIELD
Ronald Alfred Blanken (Ph.D. Thesis) 1968 95 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-9672

The microwave emission characteristics of a two component electron plasma were examined in the frequency range about the second harmonic of the non-relativistic electron gyrofrequency Ω_c. The two component distribution consists of a tenuous hot component which has a loss cone distribution and a dense finite temperature background component. Two types of emission are observed. The first occurs at the Bernstein resonance with $\omega \geq 2\Omega_c$. Anomalous diffusion into the loss cone is associated with this emission. The observed frequency of the second mode satisfies $\omega_{uh} \approx 2\Omega_c$ where $\omega^2_{uh} = \omega^2_p + \Omega^2_c$ and Ω_h is the relativistic electron gyrofrequency, and ω^2_p is the electron plasma frequency. No enhanced loss of hot electrons is observed with the second type of emission. A theory is developed which treats the unstable interaction of a relativistic distribution of electrons with short-wave-length electrostatic waves propagating nearly perpendicular to the static magnetic field. The theory predicts the growth rate as a function of the wave frequency, and the results are compared with the observed emission spectrum using distribution functions qualitatively similar to the experimental distribution $f(P_{||}, P_{\perp})$. Dissert. Abstr.

N69-18469*# Ling-Temco-Vought, Inc., Dallas, Tex. Nuclear Sciences Group.
INVESTIGATION OF ELECTRON INTERACTION IN MATTER Final Report, Feb. 9, 1967–Feb. 9, 1968
William E. Dance, Walter J. Rainwater, Jr., and David H. Rester Feb. 1968 334 p refs
(Contract NAS8-21055)
(NASA-CR-98275; Rept-0-71000/8R-2) Avail: CFSTI CSCL 20H

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2. ELECTRON BREMSSTRAHLUNG CROSS SECTION MEASUREMENTS AT INCIDENT ELECTRON OF 0.2, 1.0, 1.7, AND 2.5 MeV, PART 2 D. H. Rester and W. E. Dance p 243-282 refs (See N69-18471 08-24)

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N69-18470*# Ling-Temco-Vought, Inc., Dallas, Tex. Nuclear Sciences Group.

MEASUREMENT OF ELECTRON SCATTERING IN ALUMINUM AT 1.0 MeV FOR NON-NORMAL INCIDENCE, PART 1

David H. Rester and Walter J. Rainwater, Jr. *In its* Invest. of Electron Interaction in Matter Feb. 1968 p 1-242 refs (See N69-18469 08-24)

Avail: CFSTI CSCL 20H

Al and Au targets were bombarded at thicknesses corresponding to 0.2, 0.4, and 0.6 g/cm^2, with the electrons directed perpendicularly to the target. Energy distributions of the transmitted electrons as a function of angle relative to the incident beam were obtained, and from this data angular distributions were derived. Total transmission spectra and transmitted fraction were also obtained, as well as similar data for the reflected electrons from targets of Al, Fe, Sn, and Au[3]. The most important characteristic of electron distributions due to scattering from a target at non-normal incidence to the incoming electron beam is that the transmitted beam is nearly axially symmetric about the target normal. The backscatter distribution, however, no longer has this symmetry for non-normal incidence, although the maximum angular distribution does occur at the angle of reflection. These results for electron transmission in the region of diffusion show that the effects due to angle of incidence of the beam may be accounted for in a simple way, and, in addition, extend the usefulness of one dimensional Monte Carlo calculations. A.C.R.

N69-18471*# Ling-Temco-Vought, Inc., Dallas, Tex. Nuclear Sciences Group.

ELECTRON BREMSSTRAHLUNG CROSS SECTION MEASUREMENTS AT INCIDENT ELECTRON ENERGIES OF 0.2, 1.0, 1.7, AND 2.5 MeV, PART 2

David H. Rester and William E. Dance *In its* Invest. of Electron Interaction in Matter Feb. 1968 p 243-282 refs (See N69-18469 08-24)

Avail: CFSTI CSCL 20H

Measurements of the intermediate energy range, that below 4.0 MeV down to the non-relativistic energies, were made in search of an exact theory for predicting the electron-bremsstrahlung cross sections for this transition region. Computational difficulties encountered in obtaining the exact values have prevented establishing such a theory; those values available for comparison were obtained using the Born Approximation. In this experiment, measurements were made at 1.0, 1.7, and 2.5 MeV and at the additional energy of 0.2 MeV, with cross section values being reported for thin targets of Al, Cu, Sn, and Au (Z = 12, 29, 50, and 79). The data are plotted along with the corresponding Born approximation values. The results of the measurements were not completely conclusive, due to significant disagreement with at least one set of existing data in this area, but do favorably appear to provide a consistent set of cross sections from 0.2 to 10.0 MeV when compared with other work and the Born approximation values. The greatest problem remaining in the intermediate energy range is determining the magnitude of bremmsstrahlung produced by the interaction between the bound atomic electrons and the incoming bombarding electrons, necessitating further work using Be targets. A.C.R.

N69-18472*# Ling-Temco-Vought, Inc., Dallas, Tex. Nuclear Sciences Group.

ELECTRON BREMSSTRAHLUNG PRODUCED IN THICK TARGETS AT INCIDENT ELECTRON ENERGIES OF 0.2, 1.0, 2.0, AND 2.8 MeV, PART 3

William E. Dance, and David H. Rester *In its* Invest. of Electron Interaction in Matter Feb. 1968 p 284-330 refs (See N69-18469 08-24)

Avail: CFSTI CSCL 20H

Results of a continuing experimental study of thick target bremsstrahlung production are presented, the importance of the study being in the need for determination of absolute intensities for space shielding programs. In the present work, earlier measurements were extended to include the incident energy range down to 0.2 MeV and the range of atomic numbers to Be, Sn, and Au. Intensity measurements were made on Be, Al, Fe, Sn, and Au at incident energies of 0.2, 1.0, and 2.0 MeV; and on Al, Fe, Sn, and Au at 2.8 MeV. Intensities were measured at photon emission angles ranging from 0 deg to 150 deg to the incident beam direction; targets were of sufficient thickness in each case to stop the electrons. The experimental spectral distributions of bremsstrahlung intensity for values of the bombarding energy T_0 of 0.2, 1.0, 2.0, and 2.8 MeV are presented. The data are then analyzed at the various energy levels to the relationships between such factors as spectral hardening, increasing atomic number Z, photon attenuation, angular distributions, and total energy radiated. A detailed discussion of the experimental errors in the measurement of bremsstrahlung cross sections is also given. A.C.R.

N69-18473 Purdue Univ., Lafayette, Ind.

DISPERSION THEORY AND MULTICHANNEL POTENTIAL MODEL OF π N SCATTERING IN THE I=J=1/2+ STATE

Bidhanchandra Ishwerlal Sheth (Ph.D. Thesis) 1968 113 p

Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-12616

Recent calculations of Doolen, Kanki and Tubis using a single channel N/D formalism with a variant of Balázs method, have given results which are consistent with the picture of nucleon as a composite particle state whose approximate mass and coupling with pions are deducible from standard assumptions concerning charge independence, crossing symmetry, analyticity and unitarity. However, their calculated πN, I=J=1/2$^+$ state phase-shift is in strong contradiction with experiment. We modify the formalism of Doolen et. al., to include effects of inelasticity using the modified phase representation and the R method with the phase representation. The calculated nucleon parameters $g^2/4\pi$ and m are roughly the same as those found by Doolen et. al., but the calculated phase-shift still differs considerably from the experimental one. Dissert. Abstr.

N69-18474 Yale Univ., New Haven, Conn.

ASSOCIATED PHOTOPRODUCTION OF CHARGED K MESONS AND HYPERONS

James David Tyson (Ph.D. Thesis) 1968 198 p

Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 68-13216

A search was made for heavy mass elementary particles produced from hydrogen by gamma rays with energies from 4.0 to 6.0 BeV, according to the reactions: (1) $\gamma + p \rightarrow K^+ + Y^{*0}$ and (2) $\gamma + p \rightarrow K^- + Z^{*++}$, where the Y^* is uncharged and has strangeness −1 and isotopic spin of 0, 1, or 2. The strangeness +1 Z^* must have a charge of +2 and isotopic spin of 1 or 2. The existence of the short-lived Y^* or Z^* hyperons was deduced by studying the K meson yield. The K mesons were detected by differential gas Cerenkov counters and momentum analyzed by bending magnets and scintillation counters. The spectrometer momentum was kept fixed while the peak energy of the gamma ray beam was varied, and the resulting K meson yield curve was analyzed for evidence of hyperon production according to the above reactions. Dissert. Abstr.

N69-18475 California Inst. of Tech., Pasadena.
REGGEIZATION OF SOME UNEQUAL MASS PROCESSES INVOLVING HIGHER SPINS: THE REACTIONS $\pi^+N \rightarrow VN$, $\pi^+N \rightarrow V\Delta$, AND $\gamma^+p^+ \rightarrow \pi^+n$
Lorella Margaret Jones (Ph.D. Thesis) 1968 99 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-13069

The method chosen for reggeization of helicity amplitudes first separates kinematic zeros and singularities from the parity-conserving amplitudes and then applies results of Freedman and Wang on daughter trajectories to the remaining factors. Kinematic constraints on helicity amplitudes at $t=0$ and $t=(M-M_\Delta)^2$ are also considered. It is found that data for reactions of types $\pi N \rightarrow VN$ and $\pi N \rightarrow V\Delta$ are consistent with a model of this type in which all kinematic constraints at $t=0$ are satisfied by evasion (vanishing of residue function). As a quantitative test of the parametrization, experimental differential cross sections of vector meson production reactions dominated by pion trajectory exchange are compared with the theory. It is found that reduced residue functions are approximately constant, once the kinematic behavior near $t=(M-M_\Delta)^2$ has been removed. Dissert. Abstr.

N69-18476 Florida State Univ., Tallahassee.
A FINITE-RANGE, TWO-MODE, GENERALIZED DISTORTED-WAVE BORN-APPROXIMATION ANALYSIS OF DIRECT NUCLEAR REACTIONS
Thurman Lamar Talley (Ph.D. Thesis) 1968 213 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 68-13249

The theory of direct nuclear reactions has been used to develop a procedure for a finite-ranged, distorted-wave, Born-approximation calculation using both direct and exchange modes. This procedure has been designed to allow great flexibility of use including the ability to perform detailed interaction investigations. An example of the improved computational ability is the two-mode, finite-ranged, calculation of the reaction $Be^9(p,\alpha)$. It is shown that neither the direct nor the exchange mode can reproduce the experimental data separately; but rather, both modes are necessary to obtain successful fits. An estimate of the cluster model reduced widths has been made from the parameters which give the best agreement with the data. Dissert. Abstr.

N69-18477 Carnegie-Mellon Univ., Pittsburgh, Pa.
THE STUDY OF MUONIC X-RAYS FROM SEPARATED ISOTOPES OF EUROPIUM AND FROM LUTETIUM
Marcia Naomi Feinbaum Suzuki (Ph.D. Thesis) 1968 89 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-10713

The K and L X-rays have been observed from muonic atoms of separated isotopes of europium and from lutetium. The study of the two isotopes of europium is of interest because Eu^{153} is highly deformed, while Eu^{151} is more nearly spherical; Lu^{175} is also very deformed. A modified Fermi charge distribution was used in the analysis of all three nuclei. The Eu^{153} and Lu^{175} spectra were analyzed under the assumption of the validity of the rotation model. This model cannot be used for Eu^{151}, and for the analysis of this nucleus, excitation to only the 21.7 keV state was invoked. Values for the charge distribution parameters, c_0 and t, were found for all three nuclei. The intrinsic quadrupole moments, Q_0, for Eu^{153} and Lu^{175} were found to be (7.01 ± 0.10)b and (8.02 ± 0.12)b, respectively. For Eu^{151}, the ratio of the spectroscopic quadruple moment of the 21.7 keV state to that of the ground state was found to be (1.57 ± 0.24) and the reduced transition probability, B(E2), of the transition to the ground state is $(0.054 \pm 0.015)\ e^2 10^{-48} cm^4$ Dissert. Abstr.

N69-18495 Washington Univ., Seattle.
A MEASUREMENT OF THE NEUTRON-NEUTRON SCATTERING LENGTH
David Robert Nygren (Ph.D. Thesis) 1968 179 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 68-12708

The neutron–neutron S-wave singlet scattering length has been determined through the use of the reaction $\pi^- + d \rightarrow n + n + \gamma$. In this reaction the final state interaction of the neutrons can produce large deviations from phase space from phase space distributions for the reaction products. To produce the reaction, negative pions were stopped in a liquid deuterium target. All three reaction products were detected in coincidence using an annular array of fourteen liquid scintillator neutron detectors and six gamma detectors of the lead-plastic scintillator sandwich type. For each event the neutron energies were determined from measurements of the flight times between the target and the detectors. In addition, the directions of the neutrons and the gamma ray were recorded, providing two constraints for background rejection. Dissert. Abstr.

N69-18510 Vanderbilt Univ., Nashville, Tenn.
THE MEASUREMENT OF HIGH-ENERGY CHARGE TRANSFER CROSS SECTIONS FOR INCIDENT PROTONS AND ATOMIC HYDROGEN IN VARIOUS GASES AND THE K-, L-, AND M-AUGER, L-COSTER-KRONIG, AND THE CONVERSION-ELECTRON SPECTRA OF PLATINUM IN THE DECAY OF 195 Au
Larry Howard Toburen (Ph.D. Thesis) 1968 241 p
Avail: Univ. Microfilms: HC $11.05/Microfilm $3.15 Order No. 68-12796

Single-electron capture and loss cross sections were measured for incident protons and hydrogen atoms, respectively, in the energy range 100 to 2500 keV. The target gases studied were H_2, He, Ar, Kr, N_2, O_2, CO, CO_2, H_2O, CH_4, C_2H_4, C_2H_6, and C_4H_{10}. These cross sections were found to vary with incident particle velocity according to a power law for energies above approximately 300 keV except where capture from inner electron shells was evident. Velocity dependences of the cross sections were found to agree approximately with Bohr's predictions. Double-electron capture cross sections were measured for incident protons with energies in the range from 75 to 250 keV and for the target gases H_2, He, Ar, Kr, N_2, and H_2O. The K-, L-, and M-Auger and L-Coster-Kronig spectra of platinum in the electron capture decay of ^{195}Au were measured by means of the Vanderbilt iron-free, double-focusing spectrometer. Twenty-four internal conversion lines in the decay of ^{195}Au were studied at high resolution by means of the Vanderbilt spectrometer. Dissert. Abstr.

N69-18529 Yale Univ., New Haven, Conn.
ANALYSIS OF LOW ENERGY N 14(N 14, N 13)N 15 AND Be 9(Li 7, Li 8)Be 8 DATA
Dennis Anthony Torchia (Ph.D. Thesis) 1968 179 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 68-13214

The nucleon tunneling theory of Breit is employed in the analysis of the $^{14}N(^{14}N, ^{13}N)^{15}N$ and $^9Be(^7Li, ^8Li)^8Be$ reaction data. A partial wave formulation of the theory is applied, using the two level approximation, neglecting the dynamic reaction terms, and employing the j-j coupling configurations to compute the transfer function β. In the ^{14}N case, an analysis is made of improved measurements of the differential and total cross sections with special attention given to laboratory energies $E_l \leq 16.0$ MeV, which are below the Coulomb barrier. Optical potentials are employed in obtaining fits to the data without dependence on contributions to neutron transfer from internuclear distances small enough to cause appreciable coalescence of the two nuclei.

Potentials are found which simultaneously provide fits to the ^{14}N–^{14}N elastic scattering data and the neutron transfer data. In applying the theory to $^{9}Be(^{7}Li, ^{6}Li)^{8}Be$, fits were not obtained to the angular distribution data at large angles. Possible sources of the discrepancy between theory and experiment are discussed. Dissert. Abstr.

N69-18530 University of Southern Calif., Los Angeles.
STUDY OF THE He 3(p,d)2p FINAL STATE INTERACTION AT 30.2 AND 46.0 MeV
Chia-Cheh Chang (Ph.D. Thesis) 1968 103 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-12026

In the experiment described the $He^{3}(p,d)2p$ reaction ΔE-E studied at proton energies of 30.2 and 46.0 MeV. The He^{3} gas (nominal purity was 99.98%) was contained in a small gas cell which was placed inside a large vacuum chamber. The emerging deuterons were detected with a ΔE–E counter telescope in conjunction with a two-dimensional pulse height analyser. Deuteron energy spectra at eight different angles in the range 10° to 40° (Lab.) for E_p = 30.2 MeV, and twelve different angles in the range 13° to 50° (Lab.) for E_p = 46.0 MeV were obtained. The results showed that at both energies the peaking near the high energy cut-off, interpreted as due to the final state p-p interaction, decreased very rapidly as the angle of observation was increased; it reached a minimum at about 22.5° (Lab.) and a second maximum at about 35° (Lab.). The angular distributions attributed to the final state interaction were obtained by integrating the deuteron energy spectra between the limits corresponding to a relative p-p energy of 0 to 4 MeV. Dissert. Abstr.

N69-18531 Purdue Univ., Lafayette, Ind.
THE MEASUREMENT AND DISTORTED-WAVE BORON-APPROXIMATION ANALYSES OF SOME 19-MeV (α,p) DIFFERENTIAL CROSS SECTIONS FOR N 14, P 31, AND S 32
Donald Lewis Deardorff (Ph.D. Thesis) 1968 103 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-12539

The differential cross sections for the (α,p) reactions leading to the ground, 0.871, 3.058, and 3.846 MeV states of O^{17} (E_α = 18.72 MeV); and the ground, 2.13, and 3.30 MeV states of S^{34} (E_α = 18.72 MeV); and the ground, 1.220, and 1.762 MeV states of Cl^{35} (E_α = 19.18 MeV) were measured from approximately 10° to 170° at 5° intervals. The N^{14}, P^{31}, and one kind of S^{32} targets were prepared by the thermal vacuum deposition of Melamine (various thicknesses from 200 to 900 μg/cm²), red phosphorus (603 and 640 μg/cm²), and antimony sulfide (440 μg/cm²), respectively, onto thin (≈ 15 μg/cm²) Formvar films. The second kind of S^{32} targets were fabricated from a lamination of several thin Formvar films which were produced from a solution containing dissolved elemental sulfur and had approximate thicknesses of 200 μg/cm². The proton spectra were measured using a spectrometer system. Dissert. Abstr.

N69-18534 Brandeis Univ., Waltham, Mass.
SEPARABLE POTENTIAL HAMILTONIANS AND THE INTERACTION OF LIGHT WITH MATTER
Sheldon L. Trubatch (Ph.D. Thesis) 1968 261 p
Avail: Univ. Microfilms: HC $11.95/Microfilm $3.40 Order No. 68-9944

Several models describing the interaction of a non-relativistic recoiling particle with a quantized field have been investigated in order to develop non-perturbative approximation techniques for the treatment of recoil induced non-linearities in the coupling. The dipole approximation has also been applied to these problems in order to study the divergence difficulties associated with point interactions. Because many of the techniques used are based on the diagonalization of quadratic forms, the theory of linear, homogeneous, canonical transformations is extensively developed and physical quantities are expressed in terms of the diagonalizing bases. As a by-product, a class of non-linear integral equations is reduced to Fredholm form. The full Recoil Pair Theory is treated in the General Harmonic Approximation, which is a formal method of diagonalizing the maximum quadratic piece of any Hamiltonian and is, thus, equivalent to the suppression of virtual pair production in the first order of perturbation theory. Dissert. Abstr.

N69-18536 Pennsylvania Univ., Philadelphia.
A SELF-CONSISTENT MICROSCOPIC THEORY OF THE NUCLEAR COLLECTIVE HAMILTONIAN
Robert Edward Johnson (Ph.D. Thesis) 1967 175 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-9209

This dissertation contains the development of a microscopic theory of the Bohr-Mottelson Hamiltonian which describes vibrational and rotational collective motion in heavy nuclei. It is shown that one can derive a closed set of equations from which the parameters associated with the collective Hamiltonian can, at least in principle, be determined self-consistently. The derivation is based upon the generalized Hartree Fock approximation which was formulated by Klein and Kerman. The equations which are obtained contain the unknown parameters belonging to the various terms of the collective Hamiltonian and certain amplitudes which connect states described by the collective variables for the nucleus in question and for the adjacent nuclei formed from the first by destroying or creating one particle. It is a basic idea of collectivity that in many-particle system the addition or loss of a single particle can change the collective motion only slightly. Consequently these amplitudes must be sharply peaked when the collective variables describing the adjacent nuclei coincide. Thus, these amplitudes are expanded in terms of their moment functions. Dissert. Abstr.

N69-18539 Princeton Univ., N. J.
EXTERNAL FIELD PROBLEM FOR HIGHER SPIN PARTICLES
Anton Z. Capri (Ph.D. Thesis) 1967 92 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-8909

The Weinberg field equations for higher spin fields are studied. We prove that if they are coupled minimally to an external electromagnetic field, they define a field that is local and gives rise to a unitary S-matrix. Indeed, we reduce the q-number problem defined by the coupled field equations to a c-number problem. The c-number problem consists of having to solve the coupled inhomogeneous field equations for a C^∞ function with zero initial or final conditions. In the case of the Weinberg equations, we obtain an existence and uniqueness theorem for the c-number problem. The main part of the thesis is concerned with studying the properties of the mapping T_f and a corresponding mapping T_g. Using these mappings, we obtain closed form expressions for the interacting field Green's functions in terms of the free field Green's functions. Dissert. Abstr.

N69-18544*# Stanford Univ., Calif.
[PHOTOEMISSION STUDIES OF SOLIDS] Quarterly Status Report, Period Ending 31 Oct. 1968
W. E. Spicer 31 Oct. 1968 14 p refs
(Grant NGR-05-020-066)
(NASA-CR-99765; QSR-2) Avail: CFSTI CSCL 07E

The energy bands of silver chloride are being studied for a better understanding of the physics of the photographic process. The position of the Ag (4d) band, regions of high density of states in the valence band, and details of the photoexcitation process were experimentally determined by photoemission techniques. Yield and energy distribution of photoemitted electrons were measured in a range of photon energies extending through 11.8 eV on

epitaxial thin films of AgCl prepared by evaporation in ultrahigh vacuum. A summary of a second study is presented in which energy distribution curves and quantum yields were obtained for the alkali iodides LiI, NaI, KI, RbI, and CsI. Attention was focused on the doublet structure observed in the valence states of these materials.
K.W.

N69-18553 Michigan Univ., Ann Arbor.
A CALCULATION OF DISSOCIATION ENERGY OF THE HYDROGEN MOLECULE IN ITS GROUND STATE
Kurt Frederick Lauckner (Ph.D. Thesis) 1968 114 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-13346

This work investigates a method for the calculation of the dissociation energy of the hydrogen molecule which is more efficient than methods used previously by others. It is based on the use of a generalized James and Coolidge type wave function; but it differs from other methods by using confocal elliptic coordinates with r_{12} as one of the coordinates and in the use of fractional negative powers in the wave function. After transforming the Hamiltonian to the new coordinate system it is found that certain integrals involved in the calculation of the ground state energy require numerical integration procedures. This disadvantage is outweighed by the small number of basis states needed to obtain energies comparable to the work of others. Both a single term and a two term wave function are investigated. The results show that the two term wave function, which makes use of fractional and negative powers of the coordinates, produces energies comparable to those of authors using four and five term wave functions.
Dissert. Abstr.

N69-18560 California Univ., Los Angeles.
MEASUREMENT OF THE BRANCHING RATIOS OF DECAY OF THE K POSITIVE MESON
Michael Edward Zeller (Ph.D. Thesis) 1968 147 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-12478

A measurement of the rates $K^+ \rightarrow \pi^0 + \pi^+$, $K^+ \rightarrow \mu^+ + \pi^0 + \nu$, and $K^+ \rightarrow e^+ + \pi^0 + \nu$ with respect to $K^+ \rightarrow \mu^+ + \nu$ has been made using a magnetic spectrometer and spark chambers. Both the range and momentum of the charged decay product are observed and compared with a Monte Carlo calculation of these quantities. The decay in flight of the K^+ and scattered pions is rejected by means of a decay time requirement. The possibilities that a large form factor dependence of momentum transfer would cause the $K_{\mu 3}/K_{e3}$ ratio to be strongly affected has been investigated. Such a dependence does not improve the agreement between branching ratio measurements and polarization measurements of the parameter ξ. The results of the branching ratio measurement are $\Gamma(K_{\mu 2}) = (65.0 \pm 0.9)\%$, $\Gamma(K_{\pi 2}) = (19.8 \pm 1.1)\%$, $\Gamma(K_{\mu 3}) = (3.5 \pm 0.6)\%$, and $\Gamma(K_{e3}) = (4.4 \pm 0.4)\%$. These results have been normalized to 100% assuming $\Gamma(\tau) = (5.57 \pm 0.03)\%$ and $\Gamma(\tau') = (1.71 \pm 0.07)\%$.
Dissert. Abstr.

N69-18562 State Univ. of Iowa, Iowa City.
A STUDY OF THE REACTIONS NEGATIVE KAON PLUS PROTONS YIELDS NEGATIVE KAON, PROTON, POSITIVE NEGATIVE AND NEUTRAL PIONS AND NEGATIVE KAON, PLUS PROTON YIELDS NEGATIVE KAON, NUCLEON, TWO POSITIVE AND ONE NEGATIVE PION AT 4.6 AND 5.0 BEV/C
Roland Edwin Juhala (Ph.D. Thesis) 1968 143 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-10468

The final states $K^+P\pi^+\pi^-\pi^0$ and $K^-N\pi^+\pi^+\pi^-$ were studied in K⁻P interactions at 4.6 and 5.0 BeV/c. The data were prepared from 28000 pictures at each momentum taken in the 80" bubble chamber at Brookhaven National Laboratory. The cross sections for production of the final state $K^-P\pi^+\pi^-\pi^0$ are .76 ± .09 mb and .93 ± .12 mb, and for the final state $K^-N\pi^+\pi^+\pi^-$ .42 ± .06 mb and .39 ± .07 mb at 4.6 and 5.0 BeV/c, respectively. The effective mass distributions were studied by combining the data from both momenta. The effective cross sections for the combined data are .83 ± .12 mb for the $K^-N\pi^+\pi^+\pi^-\pi^0$ final state and .41 ± .07 for the $K^-N\pi^+\pi^+\pi^-$ final state. In general these two final states exhibit much larger four-momentum transfers to the baryon than the corresponding three- or four-body final states. Center of mass angular distributions for the baryon resonances were significantly backward peaked, while the K* distributions were forward peaked, but no more so than for the background obtained by slicing above and below the resonance region. Quasi-two-body production due to small contributions from several channels, while marginal, could not be excluded.
Dissert. Abstr.

N69-18573 New Mexico State Univ., University Park.
INTEGRATED YIELD AND ENERGY DISTRIBUTION OF ALPHA PARTICLES AT 145 DEG FROM CARBON 12 DISINTEGRATED BY 17.5-MeV ELECTRONS
Traugott Ender (Ph.D. Thesis) 1968 85 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-13538

Electrodisintegration of $^{12}_{6}C$ into three alpha particles has been observed with a silicon surface barrier detector at 145° from the incident beam of 17.5 MeV electrons. The integrated cross section for the reaction is (4 ± 2) μb-MeV/sr. The break-up of $^{12}_{6}C$, which is caused by the interaction of electrons directly with the nucleus, proceeds primarily through the intermediate configuration $^{8}_{4}Be + \alpha$ to the final state 3α. This is the sequence which also dominates the disintegration of $^{12}_{6}C$ by photons. Interpretation of the experimental energy spectrum of alpha particles at 145° identifies 12 percent of the 241 events as the break-up $^{12}_{6}C^*$ (12.5) → $^{8}_{4}Be(0) + \alpha \rightarrow 3\alpha$. Another 18 percent of the nuclear reactions involve the sequence $^{12}_{6}C^*$ (11.83) → $^{8}_{4}Be(0) + \alpha \rightarrow 3\alpha$. Finally, about 69 percent of the total number of alpha particles observed are due to the excitation of $^{12}_{6}C^*$ (9.64), $^{12}_{6}C^*$ (10.1) and $^{12}_{6}C^*$ (10.84), and the break-up which proceeds through the intermediate state $^{8}_{4}Be(0) + \alpha$. Excitation of other levels of $^{12}_{6}C$, and the break-up through other possible configurations into the state 3α, account for the remaining events observed.
Dissert. Abstr.

N69-18575 Purdue Univ., Lafayette, Ind.
APPLICATION OF CURRENT ALGEBRA TO OCTET DOMINANCE IN HYPERON NON-LEPTONIC DECAY AND TO SU(2)-SYMMETRY BREAKING
Walter Andrew Simmons (Ph.D. Thesis) 1968 85 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-12618

Recent work on the non-leptonic decays of the hyperons in which the current algebra and the current-current form of the weak interaction have been used is reviewed and extended. It is noted that the weak current-current Hamiltonian could be taken to transform under SU(3) as an octet plus an arbitrary admixture of twenty-seven-plet were it not for the observed smallness of the parity violating amplitude for the dea decay $\Sigma^+ \rightarrow n\pi^+$ which is known to be engendered only by the twenty-seven-plet. Using the techniques of current algebra and PCAC the weak, parity-violating decay amplitudes are expressed in terms of matrix elements of the weak hadron currents between single baryon states. These matrix elements can then be written in terms of form factors corresponding to the vector and axial vector currents. The nucleon electromagnetic form factors are known from experiment but the other form factors needed to evaluate the amplitudes are not.
Dissert. Abstr.

N69-18578# International Centre for Theoretical Physics, Trieste (Italy).

SYMMETRY AND RECURSION RELATIONS TO THE CLEBSCH-GORDAN COEFFICIENTS OF THE HOMOGENEOUS LORENTZ GROUP

R. L. Anderson, R. Raczka, M. A. Rashid, and P. Winternitz Aug. 1967 22 p refs Supported jointly by the Natl. Sci. Found. and UNESCO Submitted for publication

(IC-67-64) Avail: CFSTI

Symmetry properties of the Clebsch-Gordan coefficients for the principal series of unitary representations of the homogeneous Lorentz group are obtained. Recursion relations are given which can be used to calculate arbitrary Clebsch-Gordan coefficients in terms of a single starting one. Author (ESRO)

N69-18589 Washington Univ., Seattle.

COUPLED STATE CALCULATIONS OF PROTON-HYDROGEN SCATTERING IN THE STURMIAN REPRESENTATION

Donald Frederick McGeer Gallaher (Ph.D. Thesis) 1967 166 p

Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-9285

The proton-hydrogen scattering problem is solved in an improved representation called the Sturmian representation. The Sturmian functions from a denumerably infinite, complete, discrete basis set without a continuum, regardless of the interparticle potential. This enables one to assess the importance of the continuum in its influence on the scattering cross sections and polarizations, a hitherto neglected effect. Comparison was made with the following proton-hydrogen scattering data: discrete transfer and excitation cross section to the 2s and 2p states; the total exchange cross section; and the total transfer probability at 3°. The theoretical results show that the effect of the continuum is quite significant, resulting in improved agreement with experiment. Dissert. Abstr.

N69-18590 Arkansas Univ., Fayetteville.

ELECTRON CAPTURE INTO THE 3s STATE AND 4s STATE OF HYDROGEN BY FAST PROTON IMPACT ON He, Ne, AND Ar

Horace Ray Dawson (Ph.D. Thesis) 1968 87 p

Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-9640

Absolute cross sections for electron capture into the 3s and 4s states of hydrogen produced by proton impact on He, Ne, and Ar were measured over the energy range from approximately 2 to 120 keV. The technique involved passing protons through a differentially-pumped collision chamber containing the target gas under study. In passing through this chamber protons capture electrons and become excited hydrogen atoms which leave the collision chamber and decay in flight through an observation chamber. Intensity of H_α radiation was measured at such a position in the observation chamber that it consisted essentially of the 3s → 2p transition. In a similar fashion the intensity of H_β radiation consisting essentially of the 4s → 2p transition was measured. These intensities, along with measurements of gas pressure, proton flux, temperature, and various fixed parameters, allowed the calculation of the absolute cross sections for electron capture into the 3s and 4s states of hydrogen as a function of proton energy. Dissert. Abstr.

N69-18591 California Inst. of Tech., Pasadena.

PHOTOPRODUCTION OF CHARGED PION PAIRS FROM HYDROGEN AT PHOTON ENERGIES BETWEEN 800 AND 1500 MeV

Wesley Loren Shanks (Ph.D. Thesis) 1968 138 p

Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-12,761

The reaction $\gamma + p \rightarrow p + \pi^+ + \pi^-$ has been studied for photon energies between 800 and 1500 MeV and for dipion masses between 510 and 900 MeV. The bremsstrahlung beam from the synchrotron was passed through a liquid hydrogen target and spark chambers were used to detect the three final particles. In addition, the proton energy was determined by a range measurement. Approximately 40,000 photographs were taken, yielding 3018 acceptable events. The results were fit to an incoherent combination of the N*(1238) resonance, the ρ^0 (750) resonance, and three-body phase space, with various models being tried for ρ^0 production. The total cross section for ρ^0 production is consistent with previous experiments. However, the angular dependence of the cross section is slightly more peaked in the forward direction, and the ratio of ρ^0 production to phase space production is larger than previously observed. Dissert. Abstr.

N69-18593 Washington Univ., Seattle.

RADIATIVE CORRECTIONS TO PION-NUCLEON COUPLING CONSTANTS

Luther Kent Morrison (Ph.D. Thesis) 1967 125 p

Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-9314

The electromagnetic corrections to the π-N coupling constants have been calculated by four methods: Feynman graphs, sidewise dispersion relations, sum rules, and current commutation relations. The results are explicitly shown to be gauge invariant. Only the nucleon intermediate state is considered in the Feynman approach and the dispersion relation approach but the effect of the N^* (1238) intermediate state is estimated in the commutation relation approach. The elastic electromagnetic form factors are used to cut off the integrals for the Feynman graphs and sum rules, and an ultraviolet cutoff is used in the dispersion integrals. The uses of PCAC and quark model current-current commutators for calculating the coupling constant shifts are discussed. Finally a comparison of the various methods is made. Dissert. Abstr.

N69-18600 Michigan Univ., Ann Arbor.

DIFFRACTION SCATTERING OF COMPOSITE PARTICLES

Jonathan Conrad Pumplin (Ph.D. Thesis) 1968 86 p

Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-13381

By means of models the scattering of a high energy particle was studied from a bound system of several particles, the scattering was calculated from the system in terms of the amplitudes for quasi-free scattering from its constituents. These amplitudes are taken to correspond to elastic diffraction scattering, which is the dominant process at many BeV energies. Applications are made to scattering of elementary particles from deuterium and other light nuclei; to deuteron-deuteron scattering, and to multiple scattering in quark models. Dissert. Abstr.

N69-18680# International Centre for Theoretical Physics, Trieste (Italy).

ON THE DIVERGENT PART OF THE SECOND-ORDER ELECTROMAGNETIC CORRECTIONS TO THE RATIO G_A/G_V

A. Sirlin (N.Y. Univ.) Aug. 1968 35 p refs

(IC-68-75) Avail: CFSTI

The divergent part of the second-order electromagnetic corrections to the axial vector matrix elements is studied. The main tool in this work is a simple extension of the Bjorken limit to the case involving the time-ordered product of three currents (or local operators). Applying this generalization to theories in which all gradient terms are assumed to be c numbers, one finds, in the overall corrections to the axial vector matrix elements, logarithmic divergences which are not present (to the same approximation in α) in the Fermi amplitude. The effect of operator gradient terms and the possible connection with the well-known divergences in

the electromagnetic mass shifts is discussed. The case of the $SU_3 \otimes SU_3$ algebra of fields is studied separately. Applying the generalization of the Bjorken limit, it is easy to identify in this theory the part of the (divergent) radiative corrections to β-decay which is associated with the mass shifts of the charged vector and axial vector mesons. After this part is removed by a mass renormalization of such mesons, the remaining divergences maintain the chiral structure, are independent of momentum transfer and amount to one-half the Bjorken correction factor. Author (ESRO)

N69-18662 Rochester Univ., N. Y.
CORRELATION THEORY OF THE ELECTROMAGNETIC FIELD IN THE PRESENCE OF RANDOM SOURCES
Demosthenes Dialetis (Ph.D. Thesis) 1968 345 p
Avail: Univ. Microfilms: HC $15.55/Microfilm $4.45 Order No. 68-9368

Relativistic formulation is presented of the second order classical and quantum coherence theory of the electromagnetic field in the presence of random sources. It is shown that the dynamics of the second order correlation tensors may be reduced to a simpler form in terms of certain tensor potentials. The gauge transformations of these tensor potentials are considered. In particular two gauges of special interest are found, analogous to the Lorentz gauge and the radiation gauge in Maxwell's electromagnetic theory. The extension of the formulation to take into account higher order coherence effects both in the classical and quantum description in terms of tensor potentials is indicated in the radiation gauge. The concepts of stationarity, homogeneity and isotropy of the electromagnetic field are introduced in terms of invariance properties of the tensor potentials under time translations, under space translations and under space rotations respectively. Some consequences of stationarity, homogeneity and isotropy on the forms and relations among the second order tensor potentials and correlation tensors are derived. Dissert. Abstr.

N69-18663 Princeton Univ., N. J.
SINGULARITIES IN THE SPACETIME OF GENERAL RELATIVITY: THEIR DEFINITION, EXISTENCE, AND LOCAL CHARACTERIZATION
Robert Paul Geroch (Ph.D. Thesis) 1968 177 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 68-8928

Consideration is given to the various theorems establishing that singularities are present in large classes of solutions of Einstein's equations. The basic concepts and definitions are reviewed which are necessary in order to formulate the theorems. The theorem of Penrose and several of the theorems of Hawking are stated, and their implications are briefly discussed. A new theorem on the existence of singularities is proven. Several global properties of spacetimes are established. It is shown that if (1) the strong principle of equivalence, (2) certain local experiments on symmetry-breaking interactions in the elementary particle domain, and (3) the CPT theorem are accepted, then spacetime must be orientable. It is proven that in principle the topology of spacelike sections in a spacetime may change in an arbitrary way from one epoch to another but that, under certain conditions, such changes are necessarily accompanied by closed timelike curves. The applications of covering manifolds to Einstein's theory in general, and to singularities in particular, are discussed. Dissert. Abstr.

N69-18669# International Centre for Theoretical Physics, Trieste (Italy).
A SYSTEMATIC SURVEY OF THE ALPHA-ALPHA INTERACTION
S. A. Afzal (Dacca AEC), A. A. Z. Ahmad (Pakistan Inst. of Nucl. Sci. and Technol.), and S. Ali (Dacca AEC) Mar. 1968 83 p refs Submitted for publication
(IC-68-2) Avail: CFSTI

In order to find an α-α potential to be tested against scattering experiment results to give clues as to the α-particle model of nuclei and the cluster model of nuclei and hypernuclei, a survey of α-α interaction is presented. The theory of α-emission is treated, earlier and recent α-α scattering results are discussed, as well as phenomenological and fundamental studies of the α-α interaction. Author (ESRO)

N69-18670# International Centre for Theoretical Physics, Trieste (Italy).
STRONG ABSORPTION MODELS FOR NUCLEAR REACTIONS AND HADRON COLLISIONS AT HIGH ENERGIES
W. E. Frahn 1966 29 p refs Presented at the Intern. Course on Nucl. Phys., 8 Oct.–16 Dec. 1966 Sponsored jointly by the Intern. Atomic Energy and the Italian Phys. Soc.
(SMR-3-41) Avail: CFSTI

Two-body collisions are described phenomenologically in terms of parameterized S-matrix elements. After recent generalization to make it suitable for quantitative analysis, this method can be used if the number of partial waves involved in the interaction is not too small and if for a reaction proceeding via a given exit channel there is a large number of competing open channels. As a result, the analysis is independent of the detailed mechanism of the strong interactions and describes features of the collision cross sections which are common to all strongly interacting two-body systems. ESRO

N69-18671# International Centre for Theoretical Physics, Trieste (Italy).
A FINITE FORMULATION OF QUANTUM ELECTRODYNAMICS
Christopher K. Ecll (Sussex Univ.) Aug. 1968 16 p refs Sponsored in part by Can. Natl. Res. Council Submitted for publication
(IC-68-79) Avail: CFSTI

A recent finite formulation of field theory is applied to quantum electrodynamics. The basic assumptions of the formulation are Bogoliubov causality and TCP invariance of the S-operator; interpolating fields are never used. Ultraviolet divergences never appear in the calculations, and there is manifest Lorentz covariance at every stage. In particular, the calculation of the proper third-order vertex is carried through. Author (ESRO)

N69-18672# International Centre for Theoretical Physics, Trieste (Italy).
CURRENT ALGEBRA AND THE VECTOR FROM FACTOR IN K_{l4} DECAYS
A. Q. Sarker (Islamabad Univ.) Jul. 1968 11 p refs Submitted for publication
(IC-68-65) Avail: CFSTI

The vector form factor in K_{l4} decays is expressed in terms of the known decay rate $\pi^0 \rightarrow 2\gamma$, using the technique of current algebra, hard pions and kaon and the assumption of PCAC. Its contributions to the various K_{l4} decay rates are then calculated and its largest value is found to be about 2% that of the axial vector rate in case of $K^+ \rightarrow \pi^+ \pi^- e^+ \nu$ decay. Author (ESRO)

N69-18673 Florida Univ., Gainesville.
THE OPERATIONAL B^N_L TECHNIQUE AS APPLIED TO PULSE PROPAGATION IN FAST NON-MODERATING ASSEMBLIES
Richard Smith Denning (Ph.D. Thesis) 1967 138 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-9495

In this work the B_L technique is extended to the investigation finite systems by operational manipulation. In the methodology of the B_L technique the inverse of the loss-terms of the Boltzmann

Operator must be determined. In infinite systems where the spatial derivatives can be removed by a Fourier transformation the loss-terms of the Boltzmann Operator become merely a multiplicative scalar. The inverse is the reciprocal of the scalar. Finite cases cannot be handled so simply. In the operational B^N_1 technique the inverse operator is represented by an infinite Neumann Series. In general the Nth-order approximation is obtained by truncating the series at the Nth term. The B^{-N}_1 dispersion law for the neutron-wave experiment is compared with P_N calculations. For large N P_N appears to approach the B^{-1}_1 model. In the die-away experiment the decay constant obtained from B^{-1}_1 theory agreed with the P_N calculations for large assemblies and with SP_2 for moderately small assemblies as expected. Dissert. Abstr.

N69-18674 IIT Research Inst., Chicago, Ill.
CLASSICAL THEORY OF EXTENDED CHARGES
Hsio-Chang Shih (Ph.D. Thesis) 1968 87 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-10131

Equations for the self-force of extended charges have been derived. These equations are used within the context of the canonical theory of electrodynamics to derive general formulae for the Cerenkov radiation from charge structures with finite spatial extent. Unusual features, e.g., a second radiation threshold, appear in the case of spherically asymmetric structures. The classical derivation of electromagnetic mass is examined in detail and the concept extended to include kinematic situations more general than heretofore considered. In partiuclar it is shown that oscillations that are not experimentally detectable by conventional means will nevertheless result in significant increases in the electromagnetic mass. Dissert. Abstr.

N69-18683 Rochester Univ., N. Y.
A MEASUREMENT OF THE NEUTRON PROTON DIFFERENTIAL CROSS SECTION AND POLARIZATION AT 200 MeV: BOTH FREE nEp AND n-p IN DEUTERIUM
Alan Richard Thomas 1968 124 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-8398

The free neutron-proton differential cross section and polarization at 199 MeV has been measured in the angular range 77° to 160°Cm. In addition, the cross section and polarization in the (n-d) reaction $n + d \rightarrow p + (n+n)$ with the proton detected was measured. A neutron beam was prepared by charge exchange scattering the 85% polarized proton beam of the University of Rochester synchrocyclotron from deuterium. The beam had an energy spread of ± 11.8 MeV, a polarization of 70%, but an intensity of only 1000 neutrons/sec. The neutrons were incident on a hydrogen or deuterium target. Recoil protons were detected by scintillation counters. The cross section, measured to 2–3%, agrees well with measurement of Kazarinov and with the predictions of the phase shift solutions $(Y\text{-}IV)_{np}$ and A-M. The deuterium rates are 60–70% of the hydrogen rates and 10–20% smaller than the calculated rates using an impulse approximation with final state interactions. Dissert. Abstr.

N69-18684 Oregon Univ., Eugene.
THE C 12(He 3, p) N 14 REACTION BETWEEN 3 AND 4 MeV
Stanley Donovan Cloud (Ph.D. Thesis) 1968 202 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 68-11947

The $^{12}C(^3He,p)^{14}N$ reaction has been investigated for ^3He energies between 3.0 and 4.05 MeV. Angular distributions of protons leading to the ground state and first two excited states of ^{14}N have been measured at 11 energies. Excitation curves for production of the same protons have been obtained at laboratory angles of 20°, 60°, 120° and 160°. A 4 MeV Van de Graaf accelerator produced the ^3He beam. Silicon surface barrier detectors were used inside an 11-inch reaction chamber to detect the protons. Particle spectra were accumulated and analyzed by means of an on-line PDP-7 digital computer. The angular distributions have been expanded as sums of Legendre polynomials of maximum order 6 by means of a least-squares fitting procedure. Over the energy interval from 3.3 to 4.05 MeV, the fifth order Legendre polynomial has been found to make a significant contribution for all three proton groups, peaking at approximately 3.7 MeV. Dissert. Abstr.

N69-18688# International Centre for Theoretical Physics, Trieste (Italy).
MODEL FOR LEPTONIC INTERACTIONS. PART II: IS THE PION THE INTERMEDIARY BOSON?
Christian Fronsdal (California Univ.) Aug. 1968 9 p refs Supported in part by the Natl. Sci. Found.
(IC-68-76) Avail: CFSTI

A suggestion by Schwinger to use a scalar boson as mediator of weak interactions is combined with a proposal by Nishijima to consider the weak interactions as second-order effects of an interaction with no first-order manifestations. It is then possible to identify the intermediary boson with the pion. In either case there is no resonance in high-energy neutrino scattering. If the interaction Lagrangian is odd under PC, then observable PC violation will occur in the third order, with qualitatively correct strength. Author (ESRO)

N69-18693 Rensselaer Polytechnic Inst., Troy, N. Y.
SLOW NEUTRON INELASTIC SCATTERING BY TRANSITION METAL HYDRIDES
Sung Sun Pan (Ph.D. Thesis) 1967 271 p
Avail: Univ. Microfilms: HC $12.40/Microfilm $3.50 Order No. 68-840

Measurements of inelastic neutron scattering by metal hydrides ZrH_2, TiH_2, ThH_2, and NbH have been made by the filter difference method and phased chopper method within the incident neutron energy range of 0.1 to 0.7 eV. The filter difference method has been used for measuring inelastic scattering of neutrons of initial energies between 0.1 and 1.0 eV in transitions to a final energy near zero. An electron linear accelerator provides an intense pulsed neutron source of large area, enabling measurements to be made at significantly higher energies than is possible with a reactor. The resolution is ±4 to 8% for neutron energy changes of 0.1 to 0.5 eV comparable to that of existing phased chopper apparatus in this energy range. Measurements include the vibrational energies, level spacings and level widths for each hydride at room temperature. Dissert. Abstr.

N69-18695# International Centre for Theoretical Physics, Trieste (Italy).
TIME REVERSAL INVARIANCE AND CORRELATION BETA-GAMMA CIRCULAR POLARIZATION
F. Janouch (Czech. Nucl. Res. Inst.) Dec. 1968 10 p refs Submitted for publication
(IC-68-117) Avail: CFSTI

The invariance with respect to time-reversal transformation has never been proved properly in weak interactions. By considering nuclear beta decay, a new T-invariance test is proposed which may be quite sensitive even to small T-violating admixtures. Comparison with measurements indicates a possible T-violation in nuclear beta decay. ESRO

N69-18702# International Centre for Theoretical Physics, Trieste (Italy).
ON A RELATIVISTIC QUASIPOTENTIAL EQUATION IN THE CASE OF PARTICLES WITH SPIN
V. G. Kadyshevsky and M. D. Mateev Sep. 1967 44 p refs Submitted for publication
(IC-67-68) Avail: CFSTI

Quasipotential equations are constructed for the relativistic scattering amplitude and the wave function of two interacting particles with spin 1/2. This is done with the help of specific covariant extrapolation of the scattering amplitude off-the-energy-momentum shell. Suitable diagram techniques are developed. The quasipotential is defined as a sum of 'irreducible' diagrams. The free part of the wave equation is spin independent and all features connected with spin appear in the interaction (quasipotential). The spin structure of the quasipotential is investigated. Author (ESRO)

N69-18717 California Univ., Berkeley.
MAGNETIC RESONANCE OF THE IONIC GROUND STATE OF ATOMS THROUGH EXCHANGE COLLISIONS WITH THE METASTABLE STATE; AND INTENSITY BEATS DUE TO COHERENT EXCITATION
Chung-Heng Liu (Ph.D. Thesis) 1967 104 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-5770

Radio-frequency resonance of the metastable state $^3P_2$ of both even and odd isotopes of Xel was observed by monitoring the change of absorption of the λ = 8409 Å resonance radiation. The metastable state of $^3P_2$ of Xe was produced and aligned by the impact of a unidirectional electron beam having high electron-current density and low energy. The high electron-current density beam has been achieved by using a diode-structure electron gun under the space-charge-neutralization condition. By using the same experimental arrangement and technique, we have observed spin-exchange-type collisions between the singly ionized ground state $^2P_{3/2}$ of Xe and the metastable state $^3P_2$ of neutral Xe, both being aligned, not oriented by electron impact. Dissert. Abstr.

N69-18719 Oklahoma State Univ., Stillwater.
POSITRON LIFETIME MEASUREMENTS IN SOME IONIC CRYSTALS AND SOME ALKYLBENZENES
Concepcion V. San Jose (Ph.D. Thesis) 1967 115 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-8491

Positron lifetimes in alkali fluorides, potassium halides, alkaline earth fluorides, isopropylbenzene and the butylbenzene group were measured by observing the time distribution of the two quanta annihilation events. The standard "fast-slow delayed coincidence technique" utilizing a multichannel analyzer and a transistorized time-to-amplitude converter was adopted. The alkylbenzenes were subjected to a de-oxygenation process in an attempt to find the effects of oxygen as a quenching factor. The effects of ion radii on the properties of the annihilation processes in single crystal alkali halides and alkaline earth fluorides were determined. Conclusive evidence was obtained that positron bound systems can exist and persist in crystals manifesting the ionic bond. The positron short mean-life is determined primarily by the halogen ion, whereas the anomalous lifetime depends on the alkali ion. Dissert. Abstr.

N69-18724# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
EXPERIMENTAL AND THEORETICAL STUDY OF YIELD AND SPECTRUM OF PHOTONS OBTAINED FROM POSITRON ANNIHILATION [ETUDE EXPERIMENTALE ET THEORIQUE DU NOMBRE TOTAL DE PHOTONS ET DE LA FORME DE LA RAIE OBTENUE PAR ANNIHILATION EN VOL DE POSITONS]
Gérard Audit, Nico de Botton, Gérard le Poittevin, Claude Schuh, and Gabriel Tamas Oct. 1968 22 p refs In FRENCH; ENGLISH summary
(CEA-R-3628) Avail: CFSTI

A computer program has been used to calculate the spectrum of photons obtained from positron annihilation in flight; the calculation takes account of multiple scattering and energy loss of positrons in the annihilation target. Results are presented in the energy range 150-450 MeV which is the one of Saclay Linear Accelerator. As a check, results of the calculation are compared with measurements carried out at the Saclay Linac of 45 MeV. Author (ESRO)

N69-18733 Pennsylvania State Univ., University Park.
RADIATIVE ALPHA CAPTURE IN Ne20
George James Highland (Ph.D. Thesis) 1967 88 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-11988

The radiative capture reaction, $^{20}Ne(\alpha,\gamma)^{24}Mg$ was studied in the region E_α = 3–6 MeV using ^{20}Ne targets (embedded in niobium or tantalum backings) prepared directly in isotope separators at Argonne and Oak Ridge National Laboratories. At least 21 resonances observed were attributed to the $^{20}Ne(\alpha,\gamma)^{24}Mg$ reaction. Only natural parity states could be observed, i.e., $J^\pi = 0^+, 1^-, 2^+, 3^-, 4^+$. Angular distributions performed at the stronger resonances determined the spin and parity in the case of ground state transitions, and restricted the possible spin values for those states which decay primarily by γ_1 radiation. The partial resonance strengths $\omega\gamma_0$, $\omega\gamma_1$, $\omega\gamma_{2,3}$ and $|M|^2$ values were determined. The $|M|^2$ values found in the present investigation, with the exception of a strong (T = 1?) 1^- resonance at E_α = 5.853 MeV, fit well with Van der Leun's survey of the distribution of gamma ray transition probabilities in the A = 20–40 nuclei. Dissert. Abstr.

N69-18747# International Centre for Theoretical Physics, Trieste (Italy).
HARTREE-FOCK THEORY FOR LIGHT α-NUCLEI
Wahby Wadia Aug. 1968 17 p refs Submitted for publication
(IC-68-73) Avail: CFSTI

The Hartree-Fock theory is discussed and formulated assuming that the Hartree-Fock Hamiltonian has the symmetries adopted in the α-particle model. Preliminary investigation of the nature of the solutions is carried out for infinitely long- and short-range central forces. Author (ESRO)

N69-18764# International Centre for Theoretical Physics, Trieste (Italy).
PARITY DOUBLING FOR BOSONS AND M = 1 PROPAGATORS
Victor Alessandrini Mar. 1968 18 p refs Submitted for publication
(IC-68-18) Avail: CFSTI

A field-theoretic projection operator for integer spin J with a 'Toller' quantum number M = 1 is constructed. It is shown in a specific example that its use, either in the context of the Van Hove model or to generate partial wave expansions for the scattering amplitude, yields naturally the phenomenon of parity doubling for boson Regge trajectories. Author (ESRO)

N69-18765# International Centre for Theoretical Physics, Trieste (Italy).
THE PHYSICAL ASPECTS OF THE CONFORMAL GROUP $SO_0(4,2)$
L. Castell Aug. 1967 17 p refs Submitted for publication
(IC-67-66) Avail: CFSTI

In the Introduction it is shown how one arrives at the conformal group $SO_0(4,2)$ as a symmetry group of elementary particle physics. The reduction of the principal series of the most

degenerate unitary irreducible representations of the conformal group with respect to the Poincaré group is carried out using the results of the reduction with respect to the maximal compact subgroup. In addition the representation of the Lie algebra of the conformal group is transformed from co-ordinate space into momentum space and the mathematical basis for a conform-invariant scalar field theory is ... Author (ESRO)

N69-18794# International Centre for Theoretical Physics, Trieste (Italy).

THE REDUCTION OF THE MOST DEGENERATE REPRESENTATIONS OF $SO_0(p,q)$ WITH RESPECT TO $SO_0(p-1,q-1)\times T_{p+q-2}$

L Castell Sep. 1967 14 p refs Submitted for publication
(IC-67-71) Avail: CFSTI

The reduction of three principal series of the most degenerate unitary irreducible representations of the identity component of the non-compact rotation groups $SO_0(p,q)$ with respect to the identity component of the inhomogeneous rotation group $SO_0(p-1, q-1) \times T_{p+q-2}$ is carried out, using the results of the reduction with respect to the maximal compact subgroup SO(p) x SO(q). Author (ESRO)

N69-18798# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

NUCLEAR MAGNETIC RESONANCE AND MOLECULAR MOTIONS IN SOLIDS [RESONANCE MAGNETIQUE NUCLEAIRE ET MOUVEMENTS MOLECULAIRES DANS LES SOLIDES]

Claude Chachaty (Ph.D. Thesis) Jul. 1968 34 p refs In FRENCH; ENGLISH summary
(CEA-BIB-127) Avail: CFSTI

Nuclear magnetic resonance (N.M.R.) may be used to study the structure and molecular motions of solids. Evidence of these motions are derived from measurements of the width and the second moment of spectra and also by the spin-lattice relaxation time. Some examples are given of the application of N.M.R. to the study of organic solids, chosen particularly amongst globular compounds, clathrates and large linear molecules. Author (ESRO)

N69-18800# International Centre for Theoretical Physics, Trieste (Italy).

FINITE-COMPONENT FIELD REPRESENTATIONS OF THE CONFORMAL GROUP

G. Mack and Abdus Salam Jul. 1968 37 p refs Submitted for publication
(IC-68-68) Avail: CFSTI

Work on realization of broken symmetry under the conformal group of space-time in the framework of finite-component field theory is reviewed. Topics discussed include: most general transformation law of fields over Minkowski space, consistent formulation of an orderly broken conformal symmetry in the framework of Lagrangian field theory, algebra of currents and their divergences, manifestly conformally covariant fields and their couplings. Author (ESRO)

N69-18803# University Coll., London (England).

CONDITIONS FOR COMPOSITENESS IN FIELD

P. Cordero Trieste Intern. Centre for Theoret. Phys. Mar. 1968 14 p refs Submitted for publication
(IC/68/16) Avail: CFSTI

The Fried-Jin derivation of the condition Z = 0 is re-examined making explicit use of the HNZ construction of a composite particle field. This leads to another condition for compositeness originally due to Nishijima. The latter condition is shown to have important implications concerning the vertex renormalization constants and the mass shift. Author (ESRO)

N69-18809# Commissariat à l'Energie Atomique, Veujours (France).

MULTIPLE COMPTON SCATTERING OF PHOTONS BY A TENUOUS GAS OF FREE ELECTRONS. SOME ASTROPHYSICAL IMPLICATIONS [DIFFUSION COMPTON MULTIPLE DES PHOTONS PAR UN GAZ TENU D'ELECTRONS LIBRES. QUELQUES IMPLICATIONS ASTROPHYSIQUES]

Gildas Rouvillois and Jean-Paul Babuel Peyrissac Oct. 1968 18 p refs In FRENCH; ENGLISH summary
(CEA-R-3627) Avail: CFSTI

The action of the black body radiation emitted by a hot spherical source upon a low density electron gas is considered. The case in which the source temperature is high enough, or the electron density low enough, for the effective photon wavelengths to remain much smaller than the average interelectronic distance, so permitting the use of the binary collision model for the Compton Scattering, is discussed in detail. It is shown that electrons can be blown away from a hot wall by radiation pressure and the implications of this effect are also considered. Author (ESRO)

N69-18811# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

DETECTION OF AN INTENSE POLYCHROMATIC GAMMA BEAM MODULATED AT 3000 MHz [DETECTION D'UN FAISCEAU INTENSE DE GAMMAS POLYCHROMATIQUES MODULE A 3000 MHz]

Hans Beil, André Veyssiere, and Pierre Daujat Oct. 1968 18 p refs In FRENCH; ENGLISH summary
(CEA-R-3620) Avail: CFSTI

This paper presents two methods of detecting a γ beam modulated at very high frequencies. The intense modulated beam was obtained by the impact of the emerging Saclay Linac electron beam on a gold target. A tentative interpretation of the physical phenomena involved in the detection processes is also given. The empirical data agree reasonably well with numerical evaluations. Author (ESRO)

N69-18822# Commissariat à l'Energie Atomique, Limeil (France).

STUDY OF THE REACTIONS $^9Be(p,\alpha)^6Li$, $^9Be(p,d)^8Be$ FROM 300 keV TO 900 keV [ETUDE DES REACTIONS $^9Be(p,\alpha)^6Li$, $^9Be(p,d)^8Be$ DE 300 keV A 900 keV]

Francoise Bertrand, Gérard Grenier, and Jacqueline Pornet Oct. 1968 16 p refs In FRENCH; ENGLISH summary
(CEA-R-3575) Avail: CFSTI

The experimental results concerning the two reactions $^9Be(p,\alpha)^6Li$ and $^9Be(p,d)^8Be$ over the range 300 to 900 keV are presented. The angular distribution, excitation and total cross-section curves are expressed in absolute values after being normalized in the manner adopted by Weber, Davis and Marion. Author (ESRO)

N69-18838# International Centre for Theoretical Physics, Trieste (Italy).

SU_3 SYMMETRY AND EFFECTIVE INTERACTIONS IN THE s-d SHELL

D. R. Kulkarni (Ahmedabad Phys. Res. Lab.) and S. P. Pandya (Ahmedabad Phys. Res. Lab.) Aug. 1968 17 p refs Submitted for publication
(IC-68-77) Avail: CFSTI

The effective interaction in the s-d shell can be characterised in terms of diagonal radial matrix elements $I^{Xn/S}_l$ in relative states of orbital angular momentum l of two nucleons, the symmetry properties of which are investigated for $T = 0$. The parameters I_{0s} and I_{2s} are shown to give exact SU_3 symmetry of the eigenfunctions. The SU_3-symmetry-breaking property of I_{0s} is explicitly demonstrated, but it is also found that in realistic calculations such

an effect is somewhat suppressed by the single-particle spin-orbit force. It is also shown that whereas the T = 1 eigenfunctions (for J = 0,2,4 for two nucleons) can be very well generated from a suitable deformed intrinsic state, the T = 0 eigenfunctions (J = 1,2,3) generated from deformed states have poor overlaps with shell model eigenfunctions in absence of spin-orbit splitting of single-particle orbits. Inclusion of single-particle spin-orbit force improves very strikingly the overlaps between the generated and the shell model T = 0 states. Author (ESRO)

N69-18846# International Centre for Theoretical Physics, Trieste (Italy).
THEOREM OF SOFT PHOTON EMISSION AND THE MAGNETIC MOMENTS OF HYPERONS
Y. Tomozawa Aug. 1968 19 p refs Sponsored in part by the U.S. AEC Submitted for publication
(IC-68-82) Avail: CFSTI

A possibility of measuring the magnetic moments of hyperons by using the theorem of soft photon emission is discussed. In passing, an extended form of the Burnett–Kroll theorem is proved in a special case: the interference term of the charge and the magnetic moments vanish to the required order of the photon momentum expansion (i.e. up to the second term) even if one measures the polarization of one of the hadrons. Author (ESRO)

N69-18847# International Centre for Theoretical Physics, Trieste (Italy).
LINEAR ISOSPIN DEPENDENCE OF PARTICLE MASSES
I. Saavedra 20 Mar. 1968 8 p refs Submitted for publication
(IC-68-22) Avail: CFSTI

It is shown that in first order of SU(3) breaking masses in a given multiplet decrease linearly with the isospin, in the quark model all resulting straight lines being parallel to each other. Agreement with experimental data is satisfactory. Author (ESRO)

N69-18849# International Centre for Theoretical Physics, Trieste (Italy).
NON-REGGE TERMS IN SINGLE CURRENT AMPLITUDES
J. C. Polkinghorne Aug. 1967 9 p refs Submitted for publication
(IC-67-87) Avail: CFSTI

It is shown from a perturbation theory model that in general non-Regge terms are to be found in amplitudes involving a single current. Complete Reggeization can only be expected in unitary amplitudes. The relation of this fact to the recent suggestion of extra terms in sum rules is discussed. Author (ESRO)

N69-18853 European Organization for Nuclear Research, Geneva (Switzerland).
STATISTICAL THERMODYNAMICS OF STRONG INTERACTIONS AT HIGH ENERGIES. PART 2: MOMENTUM SPECTRA OF PARTICLES PRODUCED IN HIGH ENERGY pp COLLISIONS
R. Hagedorn and J. Ranft *In its* Util. Studies for a 300 GeV Proton Synchrotron, Vol. 1 30 May 1967 p 69–129 refs (See N69-18851 08-11)
(CERN/ECFA-66/WG2/US-SG5/RH-JR1; Rept-66/1255/5) Avail: CFSTI

Our predictions are based on a combination of "thermodynamics of strong interactions at high energies" with some simple kinematical considerations. One can describe this model as follows: (1) "fireballs" are highly excited hadrons, which decay according to thermodynamic laws; (2) In a collision with given impact parameter the incoming particles overlap partly; (3) We assume therefore each volume element to be a virtual fireball being capable of emitting *in its rest frame* isotropically and according to a thermodynamical momentum spectrum. (4) The distributions describe a geometrical situation and are therefore energy independent so that, having them fitted to experiments at one energy, we can safely extrapolate to any higher energy. On this basis we present spectra for 300 GeV pp collisions in form of curves. Author

N69-18857 Gt. Brit. National Inst. for Research in Nuclear Science, Chilton. Nimrod Beams Physics Group.
EXPERIMENT TO MEASURE THE PRODUCTION OF STABLE PARTICLES AT 300 GeV/c
E. J. N. Wilson *In* CERN Util. Studies for a 300 GeV Proton Synchrotron, Vol. 1 30 May 1967 p 201–211 refs (See N69-18851 08-11)
(CERN/ECFA-66/WG2/US-SG2/EJNW-2) Avail: CFSTI

This note describes in outline an experiment to measure the differential cross section for production of K, π and p of both charges from a target in the 300 GeV external proton beam (EPB). The spectrum of production angles and secondary momenta to be investigated (40 to 240 GeV and 0 to 1·25°) spans three orders of magnitude of production cross section. In addition to a broad survey of this spectrum, a more detailed investigation of the variation of production with target material and dimensions at a few representative angles and momenta is envisaged. This information is essential for the efficient planning of experiments, optimisation of beam design, and especially for the solution of the complex problems of beam sharing from target stations in the EPB. In designing the experiment, care has been taken to minimize the complexity of the beam, notably by dispensing with quadrupole focussing. A solution has been found which enables almost the entire spectrum of angles and momenta to be explored from a target shared with a variable high momentum beam. Author

N69-18858 European Organization for Nuclear Research, Geneva (Switzerland). Trieste High-Energy Group.
TOTAL CROSS SECTION EXPERIMENT AT A 300 GeV/c ACCELERATOR
F. Bradamante and F. Sauli *In its* Util. Studies for a 300 GeV Proton Synchrotron, Vol. 1 30 May 1967 p 213–221 refs (See N69-18851 08-11)
(CERN/ECFA-66/WG2/US-SG2/Tr-2) Avail: CFSTI

Proposed is a "transmission" experiment to obtain total particle cross sections at high energies by using a general purpose secondary beam and Cerenkov counters to identify the particles. Example calculations for expected intensities of protons, kaons, and pions from a 10^{12} proton beam impacting on a Cu target are based on momentum spectra calculations; the total cross section is equal to the geometric cross section. Results are shown in table form. G.G.

N69-18859 Istituto Nazionale di Fisica Nucleare, Milan (Italy).
COHERENT INTERACTIONS OF COMPLEX NUCLEI AS SELECTIVE DEVICE IN THE PRODUCTION OF RESONANCES AT VERY HIGH ENERGIES
In CERN Util. Studies for a 300 GeV Proton Synchrotron, Vol. 1 30 May 1967 p 223–243 refs (See N69-18851 08-11)
(CERN/ECFA-66/WG2/US-SG2/RV3; IFUM/039/AE/1966) Avail: CFSTI

The main requirements for investigating selected systems of coherence conditions with resonance production at very high energies are summarized: (1) detection of the nuclear coherence; (2) measurements of estimate of nuclear recoiling energy; (3) measurements of the recoil direction; (4) detection of the number of outgoing particles; and (5) momentum measurement of the outgoing charged particles and overdetermination of the collision parameters to check coherent hypothesis. G.G.

N69-18861 European Organization for Nuclear Research, Geneva (Switzerland).
A 300 GeV/C ELASTIC SCATTERING EXPERIMENT
G. Manning *In its* Util. Studies for a 300 GeV Proton Synchrotron, Vol. 1 30 May 1967 p 253-270 (See N69-18851 08-11)
(CERN/ECFA-67/WG2/US-SG2/GM-1) Avail: CFSTI

Discussed is the design of an experiment capable of measuring elastic scattering of π, p, and K simultaneously up to a momentum of 300 GeV/c for laboratory angles up to $\approx$ 10 mr in a single setup. Author

N69-18862 Bergen Univ. (Norway).
SEARCH FOR QUARKS WITH 300 GeV PROTONS
Endre Lillethun *In* CERN Util. Studies for a 300 GeV Proton Synchrotron, Vol. 1 30 May 1967 p 271-278 refs (See N69-18851 08-11)
(CERN/ECFA-67/WG2/US-SG2/EL-1) Avail: CFSTI

A proton-proton collision experiment is proposed for production of high energy fractionally charged quarks by a proton beam of 300 GeV/c^2. Calculations based on a statistical model show that the production cross section for quarks increases at higher energies because there is more energy available to break through a selection rule barrier. The external proton beam used is bent by the target station magnet and the negative quarks are reflected so that only particles produced in the extreme forward direction are acceptad by the spectrometer. G.G.

N69-18863 European Organization for Nuclear Research, Geneva (Switzerland).
MEASUREMENT OF THE REAL PART OF THE FORWARD SCATTERING AMPLITUDE FOR pi SUP PLUS OR MINUS p AT MOMENTA UP TO 40 GeV/c
M. A. R. Kemp *In its* Util. Studies for a 300 GeV Proton Synchrotron, Vol. 1 30 May 1967 p 279-285 ref (See N69-18851 08-11)
(CERN/ECFA-66/WG2/US-SG5/MARK-3; Rept-67/100/5/p/cb) Avail: CFSTI

It is proposed to measure the real part of the forward scattering amplitude by measuring the differential cross-section for elastic scattering at very small angles where the Coulomb amplitude is significant. Such measurements should provide a sensitive test of dispersion relations. Selection of elastic events depends on defining the momentum lost in scattering. The momenta of scattered particles are determined to 0.3%. At 40 GeV/c the mass of one pion corresponds to 0.35% loss in momentum. The background from inelastic events should be further reduced by surrounding the hydrogen target with scintillation counters interleaved with lead sheets to veto on charged particles and γ rays from π^0 decay. A liquid hydrogen target 10 cm long and of conventional design is required. The length is chosen to minimize multiple and plural scattering corrections. Author

N69-18864 European Organization for Nuclear Research, Geneva (Switzerland).
SOME THOUGHTS ON THE DETECTION OF NEUTRAL PION-MESONS, NEUTRONS AND NEUTRINOS AT THE 300 GeV ACCELERATOR
H. Leutz *In its* Util. Studies for a 300 GeV Proton Synchrotron, Vol. 1 30 May 1967 p 287-298 refs (See N69-18851 08-11)
(CERN/ECFA-66/US-SG3/HL-1; PS/5689/mk) AVAIL: CFSTI

Discussed are devices for detection and identification of π^0 mesons, neutrons, and neutrinos in high energy interactions produced by 300 GeV proton beams. The parameters of neutrons and π^0 mesons emerging from particle collisions must be obtained by neutrino event statistics and analyses together with identification of secondaries produced by neutrino interactions. By dividing the detector arrangement into conversion thicknesses corresponding to differing radiation lengths it is possible to obtain all γ-directions and energy quantas arising from the π^0 decays; γ-momenta can be measured by the magnetic curvatures of electron and positron tracks. Liquid hydrogen offers the best conditions for measuring neutron secondaries. Neutrino and antineutrino detectors should be recorded in hydrogen or deuterium bubble chambers of adequate dimensions. G.G.

N69-18865 Istituto Nazionale di Fisica Nucleare, Milan (Italy).
PRELIMINARY CONSIDERATIONS ON THE FEATURES OF VERY HIGH ENERGY INTERACTIONS IN A BUBBLE OR SPARK CHAMBER
Ettore Fiorini *In* CERN Util. Studies for a 300 GeV Proton Synchrotron, Vol. 1 30 May 1967 p 299-308 refs (See N69-18851 08-11)
(CERN/ECFA-66/US-SG3/EF-1) Avail: CFSTI

This report has two aims: (1) to investigate preliminarly the multiplicities, angular and momentum distributions of high energy pion interactions; and (2) to study the performance of a giant bubble or spark chamber in the measure and reconstruction of a typical "quasi two body" interaction. Both problems are treated very roughly, but I am confident the results can at least give a guess on what we can expect from a giant bubble chamber or to a spark chamber at the 300 GeV/c accelerator. Author

N69-18873 Rochester Univ., N. Y.
RESONANCE ENERGY TRANSFER IN CONDENSED MEDIA FROM A MANY-PARTICLE VIEWPOINT
John Davis Dow (Ph.D. Thesis) 1968 278 p
Avail: Univ. Microfilms: HC $12.60/Microfilm $3.60 Order No. 68-9369

In this paper, the resonance energy transfer mechanism is treated from a many-particle viewpoint, and the collective nature of the excitation migration is taken into account. Assuming a non-magnetic monatomic crystal with two substitutional impurities, the initial and final states of the energy transfer process are taken to be localized excitons, or excited states of the entire system of impurities plus host crystal. First a linear chain model is used to investigate the effects of host exciton states on energy migration over short distances, and it is found that the host states modify the bare interaction between impurities and also provide a short-ranged virtual exciton mechanism for energy transfer. Then the long-ranged part of the effective interaction is treated for a three-dimensional model of a tight-binding crystal, with the effects of the impurities on the host treated within the framework of linear response theory. Dissert. Abstr.

N69-18874 Purdue Univ., Lafayette, Ind.
THE EMBEDDING OF SU(3) IN HIGHER SYMMETRIES AND APPLICATIONS TO ELEMENTARY PARTICLE PHYSICS
Darry Scott Carlstone (Ph.D. Thesis) 1968 201 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 68-12530

The higher symmetries of SU(6) and SU(8) are proposed as possible noninvariance groups of SU(3). The basic step in constructing these algebras is to embed the eight (six) dimensional representation of SU(3) in the eight (six) dimensional representation of SU(8) (SU(6)). The adjoint representation of each of these two symmetries will contain an octet which is identified with the generators of SU(3). Once this identification has been made, all representations of SU(6) and SU(8) may be classified in terms of their SU(3) context. Mass formulas for some of the more interesting representations are determined. These mass formulas are compared with the available experimental information in order to determine whether there is immediate evidence for such a scheme. It appears that there is not. Dissert. Abstr.

N69-18879# International Centre for Theoretical Physics, Trieste (Italy).

O(3,1) SYMMETRY AND P PRODUCTION AT HIGH ENERGIES: SINGLE LORENTZ POLE VERSUS SINGLE REGGE POLE

M. A. Rashid and M. Samiullah Aug. 1967 14 p refs Submitted for publication

(IC-67-65) Avail: CFSTI

The reaction $\pi N \rightarrow Np$ on the basis of the Salam, Delbourgo, Strathdee O(3,1) partial wave expansion for arbitrary t is studied. For t = 0 Sawyer's results on the completely different contributions of Freedman and Wang class II and III conspiracies to the two spin non-flip amplitudes are reproduced. To obtain the results of a single Regge pole dominance from single Lorentz pole dominance it is found that contributions of both the conspiracies are required. It is suggested that this reaction be carefully studied experimentally at high energies and at different momentum transfers in order to decide between the different possibilities. Author (ESRO)

N69-18887 Rochester Univ., N. Y.

CONTRIBUTIONS TO THE THEORY OF PHOTON COUNTING STATISTICS

Gabriel Bedard (Ph.D. Thesis) 1968 220 p

Avail: Univ. Microfilms: HC $9.90/Microfilm $3.00 Order No. 68-9355

The present analysis is primarily concerned with the photoelectron counting statistics associated with the photodetection of fluctuating light beams. As one recalls, the statistical distribution of photoelectric counts, registered in a fixed counting time interval, carries information about the statistical properties of the radiation field incident on a photodetector. In the first Section, a review of the fundamentals of photon counting statistics is presented, followed by an up-to-date survey of this branch of Quantum Optics. The present analysis provides in the last Chapter solutions to the problem of determining the probability density for the light intensity from experimentally obtained photocount distributions. The effectiveness of the method, described here, is demonstrated by an actual inversion of a typical experimental photocount distribution. The techniques, developed here are of particular interest in connection with efforts to understand the statistical behavior of optical radiation fields, especially of laser fields. Dissert. Abstr.

N69-18901 California Inst. of Tech., Pasadena.

THE MEASUREMENT OF NUCLEAR GYROMAGNETIC RATIOS OF SHORT LIVED STATES USING INTERNAL FIELDS

James David Bowman (Ph.D. Thesis) 1968 81 p

Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68

The nuclear gyromagnetic ratios of the first excited 2^+ states in ^{114}Cd, ^{122}Te and ^{124}Te have been measured to be .42 ± .06, .31 ± .03 and .22 ± .06 μ_N respectively. The perturbed gamma–gamma angular correlation method was used. The large experimentally known hyperfine fields present at the positions of the nuclei of substitutional impurity atoms in an iron lattice were used to obtain mean angles of precession large enough to be measured. The experimental results are compared with theory, and with the results of Coulomb excitation implantation measurements. In each instance the agreement is poor. Author

N69-18904# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Reaktorzentrum.

NEUTRON-PROTON SURFACE DELTA-RESIDUAL INTERACTION IN SPHERICAL NUCLEI OF UNEVEN MASS NUMBERS [NEUTRON-PROTON O BERFLAECHENDELTA-RESTWECHSELWIRKUNG IN SPHAERISCHEN KERNEN UNGERADER MASSENZAHL]

Ewald Reya (Ph.D. Thesis) 1968 108 p refs In GERMAN (SGAE-PH-77/1968) Avail: CFSTI

Developed is a microscopic theory of nucleon-nucleon residual exchange effects for spherical nuclei of uneven mass. A delta surface matrix incorporates short lived p-p or n-n- correlations as well as spin-independent n-p correlations to obtain quasi-particle calculations. The various residual-exchange effects between quasi-particles are approximated under disregard of collective effects such as nucleus rotation and vibration. An example calculation for nuclei of $93 \leq A \leq 141$ is included and compared with existing experimental results. Transl. by G.G.

N69-18910 European Organization for Nuclear Research, Geneva (Switzerland).

HYPERON BEAMS

D. Garbutt, F. F. Heymann, P. V. March, P. I. P. Kalmus, and H. J. Sherman *In its* Util. Studies for a 300 GeV Proton Synchrotron, Vol. 2 30 May 1967 p 31–37 (See N69-18907 08-11)

(CERN/ECFA-66/WG2/US-SG2/M1) Avail: CFSTI

Several possible ways of producing hyperon beams using the production process as a label were considered. The results, however, are rather discouraging. The number of Λ arriving at a scattering target would be around one per pulse and the event rate for a labelled Λ^0 beam would be at most only ≈1 per 100 minutes. Author

N69-18927 European Organization for Nuclear Research, Geneva (Switzerland).

MONTE CARLO CALCULATION OF THE NUCLEON MESON CASCADE IN A BLOCK OF SHIELDING MATERIAL—ATTENUATION OF STRONG INTERACTING PARTICLE DENSITIES PERPENDICULAR TO THE DIRECTION OF THE PRIMARY BEAM

J. Ranft *In its* Util. Studies for a 300 GeV Proton Synchrotron, Vol. 2 May 1967 p 311–342 refs (See N69-18907 08-11)

(MPS/INT-MU/EP-1) Avail: CFSTI

The development of the cascade perpendicular to the direction of the incoming proton beam is of interest for the layout of shielding around high energy accelerators (back stops, shielding of the accelerator ring tunnel, shielding of external proton beam lines). A monte Carlo method was modified by introducing particle splitting in the transverse direction. The particle fluxes were calculated inside a shielding block with the following dimensions: longitudinal, $0 \leq z \leq 4{,}000$ g/cm^2; transverse, $0 \leq r \leq 2{,}000$ g/cm^2. Protons, neutrons, and pions of momenta greater than 0.08 GeV/c are considered. The shielding materials were aluminum and steel. Input data for the calculation are the spectra for particle production in high energy collisions and the absorption length of the shielding materials. The incoming proton beam has a cross section of 1 cm^2. Graphs are given which represent the star densities for all strongly interacting particles; from these the shielding requirements can be determined for similar situations. B.P.

N69-18928 European Organization for Nuclear Research, Geneva (Switzerland).

MUON SHIELDING CALCULATIONS I

P. E. Kuhlmann and H. O. Wuester *In its* Util. Studies for a 300 GeV Proton Synchrotron, Vol. 2 30 May 1967 p 343–370 ref (See N69-18907 08-11)

(CERN/ECFA/66/WG2/US-SG5/ Avail: CFSTI

Muon spectra and muon fluxes were calculated for proton energies between 25 and 300 GeV. The differential and integral spectra of muons of one charge per effective proton collision was formulated and graphed. For the calculations of muon fluxes in the shield it was assumed that no target magnet was present. In this case the angular spread of muons is only due to the angle of production of the pions in the target, to the decay angle of the

muon, and to the multiple scattering of the muons in the shield. A sketch of the layout is depicted. Different materials were evaluated for their shielding effectiveness and the length of the shield for all considered materials is charted as a function of energy. Graphs are also included which show the shape of the shield, the dependence of the shield shape on energy, and the dependence of the shield shape on drift length for soil and iron for the different proton energies. B.P.

N69-18929 European Organization for Nuclear Research, Geneva (Switzerland).
REMARKS ON SHIELDING FOR AREA I
P. E. Kuhlmann and H. O. Wuester *In its* Util. Studies for a 300 GeV Proton Synchrotron, Vol. 2 30 May 1967 p 371–375 refs (See N69-18907 08-11)
(CERN/ECFA/67/WG2/US-SG5/PEK) Avail: CFSTI

A brief calculation is made for the iron necessary for shielding against strongly interacting particles for a distance between target stations 1 and 2 of 100 m. The shielding would be 2000 m^3 or 15,000 tons of iron for the first stage as a backstop for the muons of target station 1. The total amount of iron would then be 32,000 tons of iron. The shape of the muon shield for different drift lengths and for different materials is charted for a primary energy of 300 GeV. B.P.

N69-18934 European Organization for Nuclear Research, Geneva (Switzerland).
BEAM SPLITTING AT 50 GeV [PARTAGE DU FAISCEAU POUR L'AIRE EXPERIMENTALE A 50 GeV]
J. Parain *In its* Util. Studies for a 300 GeV Proton Synchrotron, vol. 2 30 May 1968 p 459–470 refs In FRENCH (See N69-18907 08-11)
(CERN/ECFA/66/WG2/US-SG5/JP1) Avail: CFSTI

A system was described using a thin sheet of iron magnet to split a 50 GeV beam ejected from a 300 GeV accelerator. The purpose behind this study was to set up a series of simultaneous experiments which necessitated beam splitting. Concrete shielding was used in the experimental area to absorb the proton beams. A cost estimate was made of the beam transport system. Transl. by B.P.

N69-18941# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
THE DEGENERACY AND THE "RECURRENCE" OF REGGE TRAJECTORIES IN VENEZIANO'S MODEL
Robert Lacaze (CNRS) and Basarab Nicolescu [1969] 11 p refs
Avail: CFSTI

Some consequences of Veneziano's supplementary conditions for a large class of processes are studied. In particular, the necessity of the introduction of the f', ρ_N, and ρ'_N trajectories is noted. The use of Adler's self-consistency conditions in the model is also discussed. Author

N69-18942# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.
INTERACTION BETWEEN CLUSTERS AND PAULI PRINCIPLE
Sakae Saito Dec. 1968 38 p refs
(RIFP-82) Avail: CFSTI

The Pauli principle characterizes the relative state between clusters in the overlapping region of them. A theory to clarify the role of the Pauli principle in the interaction between clusters in a simple way is proposed. The equation of motion for the realtive state, obtained as a consequence of the total antisymmetrization, excludes naturally the states forbidden by the Pauli principle. The relative state is mainly determined by the orthogonality condition to the forbidden states for the inside and by a local potential for the outside. It is shown that both the characteristic inner oscillation and the almost energy-independent nodes of the relative wave function, which appear in the α–α scattering and are interpreted as the origin of the effective repulsive core, are produced by this orthogonality condition. The features of the α–α scattering are clarified on the basis of the proposed theory. Author

N69-18950# International Centre for Theoretical Physics, Trieste (Italy).
POLE DOMINANCE AND A LOW-ENERGY THEOREM IN THE RADIATIVE DECAYS OF CHARGED KAONS
Ronald Rockmore (Imp. Coll. of Sci. and Technol.) Aug. 1968 21 p refs Sponsored jointly by the Natl. Sci. Found., U.S. AEC and the Rutgers Res. Council Submitted for publication
(IC-68-74) Avail: CFSTI

A low-energy theorem is derived for the structure-dependent axial vector form factor in the radiative decay $K \rightarrow l + \nu + \gamma$ in the soft kaon approximation. Corrections of the order of (m^2_K/m^2_V) $(V = \rho, \omega, \phi)$ are obtained in the pole-dominance approximation. In each approximation the model predictions of both (i) asymptotic SU(3) and (ii) current-mixing are investigated. It is found that the soft kaon result is shifted upward by approximately 20%; the separation between the models in the two approximations is of the same order of magnitude. Author (ESRO)

N69-18955 Washington Univ., Seattle.
A DISCRETE STOCHASTIC MODEL FOR NEUTRON MODERATION AND REGENERATION
Theodore Joseph Williamson (Ph.D. Thesis) 1967 180 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 68-9350

A general model is developed for numerical calculations of neutron slowing down parameters and functions in simple, homogeneous systems. The model assumes that slowing down can be represented as a discrete time, discrete state Markov process. Within the context of this approximation, Markovian transition probabilities and state expectations are derived from functions which describe the distributions in energy of neutrons which have suffered n scattering collisions in the state. The model is generally simple in application and requires less computation time that alternate methods such as Monte Carlo. The efficacy of the model is demonstrated on several problems in simple moderators for which analytical solutions exist. Temporal processes derivable from the time-energy distribution of a burst of neutrons slowing down are examined in detail with the model for five bare, fast reactors. The Chapman–Kolmogorov equation is applied to extend the model to a multidimensional description but it is shown that calculations in such systems are generally impractical. Dissert. Abstr.

N69-19004 California Univ., Berkeley.
NUCLEAR SPIN REFRIGERATORS
James Renfrew McColl (Ph.D. Thesis) 1967 179 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 68-10383

The enhancement of proton spin polarization by the spin refrigerator method, in crystals of $Y(C_2H_5SO_4)_3 \cdot 9H_2O$ containing a few percent Yb^{3+}, has been studied theoretically and experimentally. The spin refrigerator is operated simply by rotating the crystal in a magnetic field in a liquid helium bath, or by rotating the field by creating a pulsed field at right angles to a stationary field. Rate equations for Yb spin and proton spin polarizations are integrated to predict the polarization of the Yb and proton spins during cross relaxation. The theory is generally in excellent accord with experimentally observed proton polarizations for both pulsed field and rotating sample spin refrigerators, provided four-spin processes, in which three protons and one Yb spin flip, are taken into account. Dissert. Abstr.

N69-19008 New Mexico State Univ., University Park.
A HIGH RESOLUTION ENERGY-LOSS ANALYZER FOR INELASTIC ELECTRON SCATTERING
Douglas William Muir (Ph.D. Thesis) 1968 182 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 68-10137

A novel electron energy-loss analyzer is proposed for the study of discrete nuclear excited states by means of inelastic electron scattering at electron energies below 30 MeV. At these low energies, the detailed effects of finite nuclear size are reduced, so that one can extract the radiative width (lifetime) of the excited state without having to assume a particular model of the nucleus. In spite of this desirable feature, very few inelastic electron scattering experiments have been performed below 30 MeV, primarily because of a fundamental background problem. This background is associated with electrons that lose energy in the target because of bremsstrahlung generation rather than nuclear excitation, and it increases rapidly as the incident electron energy E is lowered. An optimum scattering angle θ for low energy experiments is 180°, where the transverse interaction between the electron and nucleus can be studied with a minimum of interference from the bremsstrahlung background. Dissert. Abstr.

N69-19011# International Centre for Theoretical Physics, Trieste (Italy).
FEYNMAN RULES FOR REGGEONS
C. Fronsdal (California Univ.) Sep. 1967 36 p refs Supported in part by the Natl. Sci. Found. Submitted for publication
(IC-67-70) Avail: CFSTI

Rules are formulated for the evaluation of Feynman diagrams in which the virtual lines represent infinite multiplets with discrete and/or continuous spectra. In the simplest case this is a theory of Reggeon Feynman diagrams. The fact that infinite multiplets can represent multi-particle states with continuous mass spectra is emphasized, and a special case of 'Compton' scattering via two-particle intermediary states is studied in detail. It should be emphasized that the mass spectrum of the infinite multiplets are perfectly general, and that no higher symmetry is implied. Author (ESRO)

N69-19012# International Centre for Theoretical Physics, Trieste (Italy).
DETERMINATION OF THE ω-ϕ MIXING ANGLES FROM WEINBERG'S SUM RULES
R. Acharya (Bern Univ.) and H. H. Aly (Am. Univ. of Beirut) Jul. 1968 8 p refs Submitted for publication
(IC-68-69) Avail: CFSTI

A non-perturbative calculation of the ω-ϕ mixing angles from Weinberg's sum rules is presented, leading to the prediction of the decay width for $\phi \rightarrow K\,K$ and decay width ratios for $\phi,\omega/0$ decay into 1^+1. It is shown that the famous 9:1:2 ratio for photoproduction of ζ,ω and ϕ, respectively, becomes 9:1.50:87. Author (ESRO)

N69-19013# International Centre for Theoretical Physics, Trieste (Italy).
LORENTZ-POLE MODEL AND POLARIZATION IN HIGH-ENERGY CHARGE-EXCHANGE PION-NUCLEON SCATTERING
N. G. Antoniou, S. R. Komy (Assyout Univ.), C. D. Palev (Bulg. Acad. of Sci.), and M. Samiullah (Osmania Univ.) Mar. 1968 13 p refs Submitted for publication
(IC-68-15) Avail: CFSTI

A mechanism for explaining the polarization in high-energy charge-exchange πN scattering is proposed, based on O(3,1) partial wave analysis. It is found that the non-vanishing polarization may be understood in terms of one Lorentz pole $\sigma_\rho = \alpha_\rho + 1$ and that it is due to the interference of ρ with another Regge pole ρ' belonging to the family $j_0 = 0$ and given in terms of σ_ρ by the relation $\alpha_{\rho'} = \sigma_\rho - 2$. Author (ESRO)

N69-19040# Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (East Germany).
INVESTIGATION OF THE LOW-ENERGY LEVEL SCHEME OF Ag 110 [UNTERSUCHUNGEN ZUM NIEDERENERGETISCHEN NIVEAUSCHEMA VON Ag 110]
Peter Winkler Jun. 1967 25 p refs In GERMAN
(ZFK-126) Avail: CFSTI

The low-lying levels in ^{110}Ag were investigated by measuring γ singles and coincidence spectra from thermal neutron capture in ^{109}Ag. The half-life of the 117.5-keV state was measured to be 33 ± 3 nsec, while the half-lives of the 198.8- and 235.9-keV states were determined to be ≤ 1.5 nsec. NSA

N69-19043 Cornell Univ., Ithaca, N. Y.
THE MEASUREMENT OF COLLISION CROSS-SECTION FOR ENERGY TRANSFER BETWEEN N = 4 STATES OF HELIUM
Richard Lee Abrams (Ph.D. Thesis) 1968 114 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-9869

Cross-sections have been measured for collisional transfer of excitation between the n = 4 atomic states of helium. A pure helium gas laser was used to selectively perturb the excited state population distribution in a pure helium gas discharge which was contained in a sample cell internal to the laser cavity. The 4^3P or 4^3F level population (depending on which laser transition is used) was directly perturbed and the population changes of laser levels and non-laser levels were measured by monitoring the laser induced changes in the sidelight emission intensity from the sample cell for the various spectral lines. The measured intensity changes were related to the population changes through the calculated spontaneous emission rates. An analytical formulation of the problem results in a set of rate equations which were used to relate the population changes of the non-laser levels to the laser level population changes. Dissert. Abstr.

N69-19044# California Inst. of Tech., Pasadena.
REGGE CUT CORRECTIONS TO REGGE POLE EXCHANGE
Steven Frautschi Oct. 1968 15 p refs
(Contract AT(11-1)-68)
(CALT-68-173; CTSL-IR-39) Avail: CFSTI

It has been believed on theoretical grounds since 1963 that scattering amplitudes have cuts as well as poles in the angular momentum. For reasons of simplicity, the cuts have usually not been incorporated in the phenomenological models used to fit data. Recently, however, Arnold has suggested a prescription which, if accepted, allows one to estimate the cuts from the poles without adding any further parameters. The cuts, thus estimated, provide a natural explanation for such phenomena as the break in pp elastic scattering, the forward spike in np charge exchange and $\gamma p \rightarrow \pi^+ n$, and the crossover of differential cross section for elastic pp and $\bar{p}\bar{p}$, $\pi^+ p$ and $\pi^- p$, etc., whereas each of these phenomena requires extra parameters in models containing only Regge poles. Author (NSA)

N69-19046# Kansas Univ., Lawrence. Nuclear Physics Lab.
LEVELS IN N 15 RESULTING FROM THE PROTON CAPTURE OF C 14
H. E. Siefken Sep. 1968 98 p refs
(Contract AT(11-1)-1120)
(COO-1120-75) Avail: CFSTI

The energy levels of ^{15}N were investigated by measuring γ angular distributions and triple correlations from the reaction ^{14}C(p,γ)^{15}N at proton energies of 250 to 650 keV. The

measurements were centered around resonances observed at 261, 352, 527, and 634 keV. Resonance strengths, decay schemes, and branching ratios were determined for states in ^{15}N. Spin assignments were made or were confirmed for a number of the levels in ^{15}N below 10.5 MeV. NSA

N69-19047# Stanford Linear Accelerator Center, Calif.
ELECTROMAGNETIC INTERACTIONS: LOW q^2 ELECTRODYNAMICS; ELASTIC AND INELASTIC ELECTRON (AND MUON) SCATTERING
W. K. H. Panofsky Sep. 1968 61 p refs Presented at the 14th Intern. Conf. on High Energy Phys., Vienna, 28 Aug.–5 Sep. 1968 Supported by AEC
(SLAC-PUB-502; CONF-680809-37) Avail: CFSTI

A discussion of quantum electrodynamics at low momentum transfers is presented, including the discrepancies on the fine structure constant, the Lamb shift, and g factors of the electron and muon. Elastic electron–nucleon and muon–nucleon scattering are discussed with emphasis on the electron–muon equality. Information from experiments on inelastic scattering of electrons by nucleons relevant to T violation, pion form factor, form factors of specific resonant states and extrapolation of inelastic electron scattering to zero momentum transfer yielding the total photon absorption cross sections, and excitation of the nucleon into the continuum are reviewed. NSA

N69-19049 New York Univ., N. Y.
ELECTRON POSITRON DECAY OF THE NEUTRAL PION
David Stephen Sachs (Ph.D. Thesis) 1967 48 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-10089

The decay of the neutral pi meson into an electron positron pair is analyzed, and the rate compared with the two photon mode. It is assumed that the vector dominance model holds, and the decay takes place in three stages; first the pion becomes two virtual vector mesons, then each of the vector mesons becomes a photon, and finally the two photons produce the electron positron pair. The two photon decay is treated by the same methods. The matrix elements arising from the lowest order Feynman diagrams for the electron positron decay process are computed approximately. Terms involving the ratios of electron mass to pion mass, and the pion mass to the vector meson masses are ignored when feasible. The predicted rate for the electron positron decay mode is 6.0×10^{-8} of the rate of the 2 photon mode, or one such decay in every 16 million pion events, and agrees with an earlier prediction. Analysis of the background caused by the electron positron photon decay mode indicates that if a sufficiently large number of pion decays are observed, and if the particle momenta are measured with sufficient accuracy, the electron positron decay mode rate can be measured by a suitable experiment. Dissert. Abstr.

N69-19113*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TRANSMISSION OF 2.43 MeV ELECTRONS THROUGH THICK SILICON TARGETS
Jag J. Singh Washington Feb. 1969 41 p refs
(NASA-TN-D-5075) Avail: CFSTI CSCL 20H

The energy and angular distribution of electrons transmitted through silicon targets of various thicknesses have been measured for perpendicularly incident electrons of energy 2.43 MeV. The transmitted electron spectra were measured with 5 mm deep lithium drifted silicon detectors. The experimental results have been compared with the Monte Carlo results obtained by Berger and Seltzer. The Monte Carol program includes the effects of secondary electrons and photons and also the effects of ionization energy-loss fluctuations. The inclusion of these effects in the theoretical calculations has reduced the discrepancy between the theory and the experiment considerably. The target thickness at which the average cosine of the deflection angles reaches its asymptotic value is measured to be 2.5 ± 0.1 millimeters for 2.43 MeV electrons normally incident on plane parallel silicon targets. Author

N69-19116# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
RENORMALIZATION OF THE σ MODEL
Benjamin W. Lee Nov. 1968 37 p refs
(Rept-68/38) Avail: CFSTI

The renormalization of the σ model in the absence of the baryon fields is considered. The model is characterized by three parameters. In order that the current algebra and the partially conserved axial vector current condition are valid in the renormalized σ-model, it is necessary that all divergences of the theory may be absorbed in two constants, the mass and the coupling constant, and no new ad-hoc parameters be introduced to remove divergences. A perturbation method is presented, in which the lowest order gives rise to the usual results of the current algebra (or chiral dynamics). It is shown that all divergences can be absorbed into the redefinitions of the mass parameter and the one coupling constant. This is achieved by demonstrating the existence of an intermediate renormalization (wherein the counter terms are precisely those of a chiral symmetric theory) which makes the theory finite. As a consequence, the mass difference between the scalar and pseudoscalar particles is finite and all the three point and four point couplings are expressible in terms of one parameter. Author

N69-19118# International Centre for Theoretical Physics, Trieste (Italy).
SEMI-RELATIVISTIC EQUATION FOR QUARK-ANTIQUARK SYSTEM
J. Fischer, N. Limic, J. Niederle, and R. Raczka Jul. 1967 30 p refs Submitted for publication
(IC-67-62) Avail: CFSTI

The Schrödinger-like relativistic equation for bound states of the two-fermion system is considered. The general properties of solutions and spectra of such equations are derived. The equation is applied to a description of the q-q system with arbitrary spin. Using the square-well potential and two ways of symmetry-breaking, the equation obtained for the q-q system is solved for pseudoscalar octet mesons. Author (ESRO)

N69-19119# International Centre for Theoretical Physics, Trieste (Italy).
REGGE POLE EXCHANGE IN CLASSICAL PHYSICS AND IN NON-RELATIVISTIC QUANTUM MECHANICS
G. Cocho, C. Fronsdal, I. T. Grodsky, and V. G. Kadyshevsky Sep. 1967 22 p refs Submitted for publication
(IC-67-89) Avail: CFSTI

The Regge trajectory parameter $\alpha(t)$ has a simple physical interpretation in classical relativistic scattering phenomena. The 'Lorentz pole parameter' σ of Toller has the same interpretation and is equal to $\alpha(0)$. Examples are worked out in detail and show a phenomenon similar to the complicated singularity structure associated with the Pomeranchuk trajectory. In the classical case, the physical interpretation imposes the requirement that $\alpha(\alpha+1)<0$, which means that only unitary representations of the Poincaré group can be exchanged. It is tempting to speculate about the possibility that similar results could be obtained in relativistic quantum theory. Author (ESRO)

N69-19123# Kyoto Univ. (Japan). Research Reactor Inst.
TWO DIMENSIONAL FOUR GROUP CALCULATIONS BASED ON PARTIAL BUCKLING
Sunao Okamoto [1968] 74 p In JAPANESE
(KURRI-TR-33) Avail: CFSTI

A new method is proposed to solve the multigroup diffusion equation. The neutron flux distribution is represented as a polynomial expression. This is useful because no change is required for its fundamental formation to accord with varying geometric factors such as shape of the section and buckling of the flux distribution. The method is applied successfully to a two-dimensional and four-group problem where the concept of partial buckling is introduced to meet the boundary conditions calculated from the flux distribution of the system. In the appendix a brief description is made of the computer code for NEAC 2203 within the number of 4 energy groups and within the number of 10 regions. NSA

N69-19124# Notre Dame Univ., Ind. Dept. of Physics.
ZERO-MASS REPRESENTATION OF POINCARE GROUP AND CONFORMAL INVARIANCE
S. K. Bose and R. Parker [1967] 7 p refs Supported in part by AEC
(COO-427-82) Avail: CFSTI

By explicit construction it is shown how to extend zero-mass, discrete spin representations of the Poincare group to corresponding representations of the conformal group of Minkowski space. Author (NSA)

N69-19132# International Centre for Theoretical Physics, Trieste (Italy).
AN UPPER BOUND ON POSSIBLE MASS SPECTRA FROM SINGLE-PARTICLE SATURATION OF CURRENT ALGEBRA SUM RULES
I. T. Grodsky, M. Martinis, and M. Swiecki Jun. 1967 10 p refs Submitted for publication
(IC-67-35) Avail: CFSTI

An important limitation on the mass spectrum such that m(j) cannot grow asymptotically faster than j, the spin of the particle, is derived. ESRO

N69-19135# Australian National Univ., Canberra. Dept. of Nuclear Physics.
THE LOW LYING EXCITED STATES OF Rh 103
J. L. Black, W. J. Caelli, and R. B. Watson [1968] 46 p refs
(ANU-P/420) Avail: CFSTI

The decay scheme for the nucleus ^{103}Rh was studied and revised. The excited states were populated either through the Coulomb excitation of ^{103}Rh or through the nuclear reaction $^{103}Rh(p,p')^{103}Rh^*$. The B(E2) values were extracted from the Coulomb excitation data. The proposed level scheme is discussed in terms of a vibrational model for ^{103}Rh, in which it is assumed that most of the negative parity states arise from the coupling of a $2p_{1/2}$ proton to the vibrational states of the neighbouring double-even core nucleus. Author

N69-19136# Australian National Univ., Canberra. Research School of Physical Sciences.
GAMMA-RAY BRANCHING RATIOS OF THE LOW-LYING LEVELS OF Al 29
D. C. Kean, K. W. Carter, and R. H. Spear [1968] 14 p refs
(ANU-P/419) Avail: CFSTI

A 12.7 cm × 10.2 cm NaI(Tl) gamma-ray spectrometer was used in conjunction with a 61 cm magnetic particle spectrometer to measure gamma-ray branching ratios for levels in ^{29}Al at excitation energies of 1.76, 2.23, 2.87, 3.07, 3.19, 3.44 and 3.58 MeV. Author

N69-19140# Minnesota Univ., Minneapolis. School of Physics.
AN AVERAGE SET OF OPTICAL TRITON PARAMETERS OBTAINED FROM THE FIT OF (t,p) ANGULAR DISTRIBUTIONS
H.-W. Barz, K. Hehl, C. Riedel, and R. A. Broglia Aug. 1968 23 p refs
(COO-1764-30) Avail: CFSTI

The angular distributions of (t,p) reactions leading to 0^+ and 2^+ states in ^{50}Ca, ^{65}Cu ($3/2^-$ L = 0 ground state and $5/2^-$ L = 2 state), ^{120}Sn, ^{156}Sm, ^{210}Pb, and ^{240}U were fitted to derive 12-MeV optical triton parameters. A mass-independent set of potential parameters was obtained which gives good agreement between theory and experiment for all nuclei considered. This set of parameters is suitable to reproduce the shape of angular distributions for L > 2. The influence of different triton parameters on relative cross sections is discussed. Author (NSA)

N69-19150# National Research Council of Canada, Ottawa (Ontario).
MUONIC X-RAYS IN Pb-206 AND POSSIBLE OBSERVATION OF NUCLEAR POLARIZATION
C. K. Hargrove, E. P. Hincks, J. D. McAndrew, R. J. McKee, D. Kessler (Carleton Univ., Ottawa) et al 1968 11 p refs
Avail: CFSTI

Muonic X-rays in Pb^{206} were measured with high precision, and two of the weak transitions involving the 2s state were identified and measured for the first time. The new constraints make it difficult to fit the data with Dirac energies calculated for a finite nucleus and corrected for radiative effects. Consistency can be achieved by depressing the calculated 1s-energy by 6.8 ± 2.3 keV, an effect tentatively interpreted as due to polarization of the nucleus by the muon. Author

N69-19151# United Kingdom Atomic Energy Authority, Harwell (England).
A CATALOGUE OF 30 MeV GAMMA ACTIVATION PRODUCTS. PART 2: RUTHENIUM TO BISMUTH
C. A. Baker and D. A. Wood Jul. 1968 53 p ref
(AERE-R-5818) Avail: CFSTI; UK 8s

The elements from Ru to Bi were irradiated with 30-MeV gamma photons under specified irradiation conditions. Gamma spectra of the active products are presented, together with a value of the specific activity, manner of identification of the nuclide present, and the nuclear reactions by which the products were formed. Author (NSA)

N69-19155# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
A REGGE CUT MODEL FOR NEUTRAL PION PHOTOPRODUCTION
A. Capella and J. Tran Thanh Van Dec. 1968 11 p refs L
(Rept-68/41) Avail: CFSTI

A model is presented for π^0 photoproduction at intermediate and high energies, based on the exchange of the ω trajectory and a cut generated by the exchange of ω and Pomeranchuk. The model is in agreement with the measured differential cross section for incident energies between 3 and 16 GeV. The predictions of the model for the polarized differential cross sections are also in agreement with the recent measurement at 3 GeV. Author

N69-19159# Minnesota Univ., Minneapolis. School of Physics.
THEORETICAL AND HIGH ENERGY PHYSICS PROGRAMS Progress Report, 1 Sep. 1967–31 Aug. 1968
31 Aug. 1968 37 p refs
(Contract AT(11-1)-1764)
(COO-1764-6) Avail: CFSTI

Research in theoretical nuclear physics and both theoretical and experimental high-energy physics at the University of Minnesota is reported. A list of publications is also presented. NSA

N69-19160# Kansas Univ., Lawrence. Nuclear Physics Lab.
GAMMA RAY DECAY IN F-19 FROM ALPHA PARTICLE CAPTURE IN N-15
D. D. Tolbert Oct. 1968 56 p refs
(Contract AT(11-1)-1120)
(COO-1120-73) Avail: CFSTI

A study of the gamma-ray decay of the compound levels at 5339, 5474, and 5498 keV in ^{19}F was made with the $^{15}N(\alpha,\gamma)^{19}F$ reaction. These levels occur at bombarding energies E_α = 1681, 1852, and 1883 keV, respectively. Unambiguous 7/2 and 9/2 spin assignments to the levels at 5474 and 2797 keV, respectively, and a tentative 1/2 spin assignment to the level at 5339 keV were made. Lifetime measurements were carried out on many levels in ^{19}F with the Doppler shift attenuation method. The lifetimes of the 1460- and 2797-keV levels were found to be 102 ± 35 and 246 ± 44 fs, respectively. The lifetime of the 2797-keV establishes a positive parity for this level and for the 5474-keV level. Comparison is made between these results and the predictions of current model calculations pertaining to ^{19}F. Author (NSA)

N69-19175# Paris Univ., Orsay (France). Laboratoire de Physique Theorique et Hautes Energies.
ON THE RELATION BETWEEN CURRENTS AND S-MATRIX
R. Omnes Sep. 1968 6 p refs
(LPTHE-TH-68/29) Avail: CFSTI

The problem of the determination of currents and the off-mass-shell extension of scattering amplitudes is considered within the context of analytic S-matrix theory, keeping up to three particles inside the unitarity relations. The technique which is used is a straightforward application of the work by Mandelstam on the N/D formulation of the three-body problem. It is found that anomalous thresholds do not play any role in the problem and that two cases can be solved explicitly, namely: the extension off the mass shell of the scattering amplitude and the computation of a form factor which tends to zero asymptotically. Author (NSA)

N69-19176# Paris Univ., Orsay (France). Laboratoire de Physique Theorique et Hautes Energies.
RISING REGGE TRAJECTORIES AND CROSSING SYMMETRY
S. Caser, J. M. Kaplan, and R. Omnes Jul. 1968 13 p refs Revision
(LPTHE-TH-68/18(REV)) Avail: CFSTI

If there are infinitely rising Regge trajectories, the asymptotic behavior of the Regge pole terms in the s and t channels cannot be compatible with each other in the whole s,t plane. Thus the background integral cannot be neglected asymptotically if crossing symmetry is to be valid. This is in contradiction with the bounds obtained by Khuri on the behavior of the background integral out of the physical region. It is shown in a mathematical example that these bounds cannot be extended outside the physical region. As a consequence of this, there does not remain any restriction either on the rate of increase of possible rising Regge trajectories except possibly a lower bound in $\sqrt{s}$ or in the behavior of the residue functions. Author (NSA)

N69-19189# Georgia Inst. of Tech., Atlanta. School of Physics.
EMISSION AND EXCITATION CROSS SECTION Progress Report, 1 Dec. 1967–30 Nov. 1968
E. W. Thomas, J. L. Edwards, and J. C. Ford 30 Nov. 1968 23 p refs
(Contract AT(40-1)-2591)
(ORO-2591-37; PR-4) Avail: CFSTI

Progress is reported on a study of the formation of fast excited H atoms by inpact of H^+, H^+_2, or H^+_3 ions on He and N_2 at projectile energies ranging from 0.15 to 1 MeV. Attention is restricted to the formation of the 3s, 3p, and 3d excited states of hydrogen. Particular attention is given to errors that might be introduced by weak-field Stark effects and to problems due to the Doppler shift of the Balmer-α emission. Results are presented for the relative values of the cross sections for charge transfer into the 3s, 3p, and 3d states of hydrogen at 150 and 350 keV. A preliminary survey indicates that cross sections for forming excited H by dissociation of H^+_2 and H^+_3 by impact on He and N_2 targets are many orders of magnitude greater than those for the charge-transfer process. NSA

N69-19210# Stanford Linaator Accelerator Center, Calif.
MIDAS: A MULTILEVEL INTERACTIVE DATA ACQUISITION SYSTEM
R. D. Russell Oct. 1968 5 p refs Presented at the 15th Nucl. Sci. Symp., Montreal, 23–25 Oct. 1968
(SLAC-PUB-511; CONF-681017-12) Avail: CFSTI

A system is described for using a medium scale computer in real time data acquisition, analysis, and control of high-energy physics experiments utilizing wire spark chambers. Author (NSA)

N69-19212# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
VALIDITY OF QUANTUM ELECTRODYNAMICS AT EXTREMELY SMALL DISTANCES
H. Alvensleber, U. Becker, William K. Bertram et al Oct. 1968 9 p refs
(DESY-68/55) Avail: CFSTI

The yield of electron-positron pairs from the reaction γ + carbon → e^+ + e^- + carbon was measured as a test of the validity of quantum electrodynamics (Q.E.D.) at very small distances. The results show that first order Q.E.D. correctly predicts the e^+e^- pair yield up to an invariant pair mass of 900 MeV/c^2. Author (NSA)

N69-19213# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
DIPOLE STATES IN DEFORMED NUCLEI
V. Feifrlik, J. Rizek, and P. Vogel Sep. 1968 21 p refs
(UJV-2081-F) Avail: CFSTI

Energies and other characteristics of the dipole states with $K^\pi = 1^-$ and 0^- of the even-even deformed nuclei in the rare-earth region were investigated. The calculations were performed by using the method of finite Fermi system theory. It was shown, that with reasonable values of the interaction constants good agreement with the experimental value of the energy and energy splitting of the giant resonance can be achieved. The integrated γ absorption cross section is close to the theoretical value given by the sum rules. The influence of the superfluid pairing correlations is small as well as that of the interaction in the particle-particle channel. Author (NSA)

N69-19214# Gulf General Atomic, San Diego, Calif.
TOTAL CROSS SECTIONS OF UC_2
G. Borgonovi and G. W. Carriveau 18 Jul. 1968 11 p refs
(Contract AT(04-3)-167)
(GA-8782) Avail: CFSTI

The neutron total cross section of depleted UC_2 was measured by the time-of-flight method in a transmission experiment. Inscattering and multiple scattering corrections were applied to the

data. Since the scattering cross section is strongly dependent on the amount of ^{235}U in the sample, a comparison with the coherent elastic cross section was made to verify that the sample contained the assessed amount of ^{235}U. The scattering cross section was derived for energies below 1 eV. NSA

N69-19220# Rome Univ. (Italy). Inst. of Physics.
MINIMAL SOLUTIONS TO THE CONSPIRACY PROBLEM AND CLASSIFICATION OF REGGE POLE FAMILIES
P. Di Vecchia (Comitato Nazl. Per l'Energia Nucl., Frascati, Italy), F. Drago (Comitato Naz. per l'energia Nucl., Frascati, Italy), and M. L. Paciello 10 May 1968 11 p refs
(NP-17689) Avail: CFSTI

A non group-theoretical approach to the conspiracy problem, based on analyticity, crossing symmetry and factorization, is presented. The solutions to all the physically interesting cases are given. A classification of Regge pole families is deduced. The results are in agreement with those obtained in the group theoretical approach. Author (NSA)

N69-19223# Laboratoire de Physique Theorique et des Hautes Energies, Paris (France).
THE "RECURRENCE" OF REGGE TRAJECTORIES IN THE CHEW-FRAUTSCHI PLOT, AS A PROPERTY OF VENEZIANO'S MODEL
Basarab Nicolescu [1968] 7p refs
Avail: CFSTI

In Veneziano's model, the intercepts of Regge trajectories can be given in terms of the external masses only. The intercepts can be computed one from the other. The Chew–Frautschi plot is derived as a general consequence of Veneziano's model. Author

N69-19228# Rome Univ. (Italy).
RADIATIVE CORRELATIONS FOR THE FRASCATI EXPERIMENT ON THE ELECTROPRODUCTION OF PIONS NEAR THRESHOLD
M. I. Balla, B. Borgia, G. V. Di Giorgio, A. Giazotto, P. Pistilli et al 17 Jul. 1968 35 p refs *Its* Note No. 180
(NP-17681) Avail: CFSTI

Radiative corrections are presented for $e + p$ elastic scattering and electroproduction interactions $e + p \rightarrow e + p + \pi^0$ and $e + p \rightarrow e + n + \pi^+$. NSA

N69-19231# Rome Univ. (Italy).
FURTHER COMMENTS ON THE DESCRIPTION OF THREE-BODY ASSOCIATED PRODUCTION IN PROTON-PROTON COLLISIONS THROUGH THE ONE-BOSON-EXCHANGE MODEL
E. Ferrari 13 Jul. 1968 26 p *Its* Note No. 178
(NP-17686) Avail: CFSTI

The parameters of the one-boson-exchange model (including pion and kaon exchange) which has been applied in a previous work to the reactions $pp \rightarrow YKN$ are re-examined in the light of the results from a recent experiment, which presents new data on Σ production. It is found that the cutoff parameters on the momentum transfer in pion exchange must be different for Λ and Σ production. Furthermore, in the former case, the relative amounts of π and K exchange cannot be determined from experiment, provided pion exchange is assumed to be dominant. Finally, a criticism is raised about the existing estimates of resonance production in the above reactions. Author (NSA)

N69-19232# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
CONSISTENCY PROBLEMS IN VECTOR MESON DOMINANCE MODELS
Wolfhart Zimmermann Aug. 1968 6 p refs
(DESY-68/46) Avail: CFSTI

Consistency problems are discussed for models where the electromagnetic field and a neutral vector meson field are coupled to the same current. It is shown that the conventional formulation of this model is inconsistent if the bare meson mass is infinite. However, no contradiction could be found for a different formulation of the model which is due to Kroll, Lee and Zumino. Finally a simple proof is given that the wave function renormalization constant of the electromagnetic field is finite in this model. Author (NSA)

N69-19233 Georgetown Univ., Washington, D. C.
NUCLEAR QUADRUPOLE COUPLING IN ICl
Rajababu Chowdary Yalamanchili (Ph.D. Thesis) 1968 119 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-12817

The microwave rotational spectrum was investigated in the 20,400 MHz region of the ICl^{35} molecule, which is the approximate center frequency of the spectrum corresponding to the $J = 2 \rightarrow 3$ transition, using a conventional Stark modulation spectrograph. The hyperfine spectrum of the transition was analyzed using the nuclear quadrupole coupling theory, and the microwave transition frequencies were calculated and found to agree well with experimental results. An attempt was made to obtain the dipole moment of ICl from the Stark shift measurements. When the experimentally obtained shifts were plotted against the square of the electric field strength for transition $F = 4 \rightarrow 5$, a straight line was obtained which passed through the origin, an anticipated result since the ICl molecule exhibits a second order Stark effect. This procedure gave a dipole moment of 1.056 D, a surprisingly large value when compared with previous intensity measurements. This discrepancy is probably due to the use of only an approximate formula, and it is emphasized that definite conclusion on the accurate dipole moment could be drawn when the proper expression for the Stark effect in a molecule with two quadrupole couplings is derived, and the experimental values are compared with those obtained from theory. Dissert. Abstr.

N69-19238 Princeton Univ., N. J.
A PATH INTEGRAL FOR SPIN
Lawrence Simon Schulman (Ph. D. Thesis) 1967 136 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-8960

A one particle theory, equivalent to the usual quantum mechanics, is developed, and studies of the relativistic version of this theory lead to some observations on spin and internal variables. It is shown that under very general assumptions any internal coordinates can be broken up into those that give rise to the spin (alone) and those that are completely internal (i.e., unaffected by Lorentz transformation). The spin space must be some coset space of the little group of the Poincare group (for the momentum in question). This is the analogue of the trivial nonrelativistic elimination of rotational coordinates in the study of, e.g., polyatomic molecules. The path integral theory takes as a classical model for spin the spherical top and quantizes this by a sum over histories. The curvature and multiple connectedness of the top coordinate space (SO(3)) provide some interesting features in the sum. The top is also used in relativistic path integral, although in that case the classical mechanics is complicated by the Thomas precession. Equivalence of this theory with the Dirac equation was proved in the case of interactions with an external electromagnetic field. The multiplicity of the top states, and a similar phenomenon for massless particles (whose states are also determined by the foregoing general observation), yields a collection of states suitable for a representation of the leptons. Dissert. Abstr.

N69-19241# California Univ., Berkeley. Lawrence Radiation Lab.
DECAYS OF NEUTRAL PSEUDOSCALAR MESONS INTO LEPTON PAIRS

C. Quigg and J. D. Jackson 24 Sep. 1968 44 p refs
(Contract W-7405-ENG-48)
(UCRL-18487) Avail: CFSTI

The branching ratio $\Gamma(P \rightarrow 1^+1^-)/\Gamma(P \rightarrow \gamma\gamma)$ is calculated to lowest contributing order in quantum electrodynamics, with a vector meson model for the pseudoscalar meson form factor. The processes $\eta \rightarrow \mu^+\mu^-$; $\eta \rightarrow e^+e^-$; $K^0_2 \rightarrow \mu^+\mu^-$; $K^0_2 \rightarrow e^+e^-$; and $\pi^0 \rightarrow e^+e^-$ are treated. Results are compared with those of previous calculations. Author (NSA)

N69-19246# International Centre for Theoretical Physics, Trieste (Italy)

REDUCTION OF THE MOST DEGENERATE UNITARY IRREDUCIBLE REPRESENTATIONS OF $SO_0(m,n)$ WHEN RESTRICTED TO A NON-COMPACT ROTATION SUBGROUP

N. Limic (Inst. Ruder Boskovic) and J. Niederle (Czech. Acad. of Sci.) Mar. 1968 40 p refs Submitted for publication
(IC-68-20) Avail: CFSTI

The reduction of the most degenerate unitary irreducible representations (of principal series) of an arbitrary $SO_0(m,n)$ group when restricted to the subgroup $SO_0(k,l)$ $m + n > k + l \geq 3$, $m \geq k$, $n \geq l$ is given. Author (ESRO)

N69-19248# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

COLLIMATION TESTS ON A COHERENT PHOTON BEAM FROM A SILICON TARGET

L. Criegee, M. Garrell, H. Sadrozinski, U. Timm, and W. Zimmermann Sep. 1968 9 p refs
(DESY-68/52) Avail: CFSTI

The narrow coherent spikes produced in strongly collimated bremsstrahlung spectra from thin silicon crystals were studied. Dependence of the spectra on crystal thickness and collimation was confirmed. The quality of the spectra obtained from internal synchrotron targets is seen to be limited because of the primary divergence of the electron beam. Author (NSA)

N69-19255# Hungarian Academy of Sciences, Budapest.

ON THE 1350 MeV LAMBDA GAMMA PEAK PRODUCED IN NEGATIVE PION-PROTON INTERACTION

G. Bozoki, E. Fenyves, T. Gemesy et al 9 Oct. 1968 6 p refs
(KFKI-22/1968) Avail: CFSTI

The existence of the $\Lambda\gamma$ peak between 1300 and 1400 MeV was supported by measurements. The explanation of this peak by means of the hypothetical $\Lambda\eta$ (1680 MeV) resonance can be rejected on a 97% confidence level. Author (NSA)

N69-19257# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf.

THREE-BODY FORCES IN THE LATTICE DYNAMICS OF LEAD

Ph. Schmuck and G. Quittner 1968 6 p refs Submitted for publication
(Contract AF 61(052)-638)
(SGAE-PH-74/1968) Avail: CFSTI

The calculation of phonon frequencies of lead by including shortrange three-body forces which are supposed to arise from third order perturbation terms in the pseudopotential, in a phenomenological manner was attempted. It is concluded that at the present stage of pseudopotential calculations the inclusion of these forces does not substantially improve the agreement with the experiment. It is conjectured that the inaccuracy in the two-body force calculation is too large compared to the expected magnitude of three-body forces. Author

N69-19258# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf

SURFACE DELTA INTERACTION (n-p) AND COUPLED BCS EQUATIONS IN SPHERICAL ODD MASS NUCLEI

E. Reya and H. Baier (Vienna Univ.) 1968 10 p refs Submitted for publication
(SGAE-PH-75/1968) Avail: CFSTI

It is shown that a surface delta interaction between identical as well as between nonidentical nucleons can explain the pairing properties of spherical odd mass nuclei in the regions $40 \leq Z \leq 48$, $53 \leq N \leq 70$; and $51 \leq Z \leq 59$, $64 \leq N \leq 82$. The coupled system of n–p pairing equations was derived with the help of Bogoliubov's compensation principle. The solutions of them were found numerically. As a conclusion, the dominant effect of n–p forces on the low lying levels and the ability of the simple SDI-model to produce an impressive agreement with experimental data in the investigated region are emphasized. Author

N69-19259 Tennessee Univ., Knoxville.

ELECTRON MEAN FREE PATHS IN A FREE ELECTRON GAS

Robert Neill Hamm (Ph.D. Thesis) 1967 80 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-9803

A theoretical study using the techniques of many-body perturbation theory is made of the mean free path for electron-electron collisions of a low-energy electron in a metal. The sum to all orders is taken of terms corresponding to a series of ladder-type scatterings of the excited electron on electrons ejected from the Fermi sphere, taking the exclusion principle in intermediate states into account. A Bethe–Goldstone equation for the system is derived and is solved numerically for the case of a screened Coulomb potential to obtain s-wave phase shifts. The cross section for electron-electron scattering is obtained for electron densities corresponding to real metals. It is found that although the correction for the operation of the exclusion principle in intermediate states acts to reduce the cross section, when the effect of the exclusion principle in final states is taken into account, the intermediate states correction is small. Dissert. Abstr.

N69-19261 Princeton Univ., N. J.

EIKONAL APPROXIMATION FOR BETHE-SALPETER EQUATION

Lawrence Harold Domash (Ph.D. Thesis) 1967 160 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-8919

The non-relativistic eikonal approximation for high-energy, nearly forward scattering is extended to the Bethe–Salpeter equation by methods adapted directly from the Schrödinger ones. The same results are obtained from a dispersion theory and the Blankenbecler–Sugar eqn. Only elastic unitarity is included, but this is satisfied asymptotically at high energies. The main method is the expansion of propagators in the vicinity of the mass-shell. A variational principle is developed to solve the resulting equation. Exact asymptotic $s \rightarrow \infty$ behaviors of some modified Born terms, such as those by Blankenbecler – Sugar are computed. The method is extended to spin 1/2-spin 0 scattering and to vector interactions. Dissert. Abstr.

N69-19263 Wisconsin Univ., Madison.

TIME REVERSAL INVARIANCE AND PROTON TRIPLE SCATTERING

Peter Jacob Limon (Ph.D. Thesis) 1968 89 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 68-7112

An incident polarized proton beam at 430 MeV was scattered in liquid hydrogen, and the final state polarization measured with a wire spark chamber, carbon plate polarimeter. The data analysis was performed on line by a digital computer. It was found that

two polarization components which would be equal if time reversal invariance was valid had a difference P_A-P_B = 0.0019±0.0090. An upper limit was set on the time reversal violating matrix element T: $|T|\cos\alpha \leq 0.01\ \sqrt{mb}$ where α is the phase angle between T and time reversal and parity conserving matrix element. The time reversal violating phase shift λ_2 was found to be less than 15% of its maximum value. In addition, the Wolfenstein triple scattering parameters D, R, A, R', and A', and the polarization P, were determined at 65° and 115° center of mass scattering angles. Using these data, a solution was found to the proton–proton M-matrix which seems to be unique. Dissert. Abstr.

N69-19271# New York Univ., N. Y. Courant Inst. of Mathematical Sciences.
LONG TERM STABILITY FOR PARTICLE ORBITS
L. Jackson Laslett, Edwin M. McMillan, and Juergen Moser 1 Jul. 1968 61 p refs
(Contract AT(30-1)-1480)
(NYO-1480-101) Avail: CFSTI

Mathematical considerations for long term stability for particle orbits in an alternating-gradient focusing structure for motion with only one spatial degree of freedom are presented. NSA

N69-19272# Japan Atomic Energy Research Inst., Tokyo. Div. of Physics.
PROGRAM ELIESE-2: A FORTRAN-4 PROGRAM FOR CALCULATION OF THE NUCLEAR CROSS SECTIONS BY USE OF THE OPTICAL MODEL AND HAUSER–FESHBACH'S METHOD
Sin-Iti Igarasi Oct. 1968 21 p refs
(JAERI-1169) Avail: CFSTI

This report describes an IBM 7090 and 7044 code, ELIESE-2. The ELIESE-2 computes elastic and inelastic scattering cross sections and reaction cross sections for neutrons, protons, alpha particles and some kinds of heavy particles by means of the optical model and Hauser–Feshback's method. Author

N69-19309# Massachusetts Univ., Boston.
ACCELERATION OF MATERIAL PARTICLES TO THE SPEED OF LIGHT IN GENERAL RELATIVITY
Freda Salzman and George Salzman 14 Dec. 1968 10 p refs Submitted for publication Supported in part by NSF
Avail: CFSTI

It is proposed that the Schwarzschild surface ($r = 2MG/c^2$) be interpreted as a dynamically "singular" surface at which material test particles attain the speed of light. It is shown that imaginary mass particles behave as the gravitational opposites of real particles. Author

N69-19314# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.
GENERATION OF ELECTRON CURRENTS BY GAMMA-RAYS
J. A. Sovka and P. T. Truant Nov. 1968 54 p refs
(AECL-3224) Avail: Atomic Energy of Can., Ltd., Chalk River: $1.50

Theoretical studies are reported of the production of electrons in a semi-infinite plate by gamma-rays interacting by Compton scattering and photoelectric absorption. Electron yields per incident photon were obtained as functions of γ-ray energies from 0.15 to 1.50 MeV, plate atomic numbers from 13 (aluminum) to 92 (uranium) and for plate thicknesses up to 1.5 g/cm^2. A limited comparison was made with results obtained from Co^{60} "Gamma-Cell" experiments. The analytical investigations are helpful in describing the behaviour of coaxial self-powered detectors operating in a similar γ-ray flux. Extension of the analysis to electron generation in a radiation field containing neutrons and γ-rays, as in a reactor core, is recommended. Author

N69-19318# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
CROSS SECTIONS FOR FAST PARTICLES AND THE ATOMIC NUCLEI
V. S. Barashenkov, K. K. Gudima, and V. D. Toneev 1968 73 p refs In RUSSIAN
(JINR-P2-4068) Avail: CFSTI

A summary is given of the available experimental data on the total cross sections and the elastic and inelastic cross sections of nucleons, antinucleons, π-mesons, and K-mesons with atomic nuclei in the range of the energies above 50 MeV. The cross sections of the nucleus–nucleus interactions are pointed out (for kinetic energies above 50 MeV/nucleon). The experimental data are discussed. Author (NSA)

N69-19319# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
INVARIANT EXPANSIONS IN A CONE AND UNITARY TRANSFORMATIONS OF THE AMPLITUDES
M. A. Liberman and A. A. Makarov 1968 27 p refs In RUSSIAN
(JINR-P2-4067) Avail: CFSTI

The functions are constructed which realize irreducible transformations of the Lorentz (at $\Delta' = 0$) and correspond to the different reductions of the Lorentz group. The functions obtained are used for invariant expansion of the scattering amplitude and for deduction of the ratio of the Pomeranchuk theorem type. The reexpansion coefficients of the functions of one complete set of the commuting operators in functions of the other set have been determined. Author (NSA)

N69-19321# Georgia Inst. of Tech., Atlanta. School of Physics.
IONIZATION AND CHARGE TRANSFER CROSS SECTIONS Progress Report, Dec. 1, 1967–Nov. 30, 1968
D. W. Martin and G. O. Taylor 30 Nov. 1968 18 p refs
(Contract AT(40-1)-2591)
(ORO-2591-38) Avail: CFSTI

Reported were product yields from charge exchange reactions with helium at 150 to 900 keV and differential cross sections of charge exchange reactions with argon at 0.4 MeV. Equipment for studies of collision reactions with gases and an analyzer system for coincidence studies of ionization and charge transfer collisions was developed. NSA

N69-19324# California Univ., Livermore. Lawrence Radiation Lab.
MOESSBAUER RECOILLESS FRACTION OF GOLD
Robert William Ohlwiler (Ph.D. Thesis—Calif. Univ., Davis) Jun. 1968 62 p refs
(Contract W-7405-ENG-48)
(UCRL-50477) Avail: CFSTI

The Moessbauer recoilless fraction, f, of the 77-keV gamma ray of ^{197}Au in a gold metal absorber has been measured as a function of temperature between 4.5 and 100°K. The source was ^{197}Au in platinum metal. The Moessbauer spectrum was fit with the absorption integral, and the recoilless fraction was derived from the shape and width of the spectrum. The recoilless fraction varies between 0.17 at 4.5°K and 0.01 at 100°K. The analysis indicates that the source and absorber lines are Lorentzian and have approximately equal widths, 0.937±0.011 mm/sec. Shirley's theoretical estimate of the internal conversion coefficient, 3.96±0.14, was assumed in the recoilless fraction calculations. The Debye temperature vs temperature corresponding to the measured recoilless

fraction was compared to that derived from theoretical phonon frequency distributions reported in the literature. An appendix gives many general properties of the Moessbauer absorption integral.
Author (NSA)

N69-19325# New England Inst. for Medical Research, Ridgefield, Conn.
SCHRODINGER EQUATION SOLUTION PROGRAMS. SUBROUTINES SJTRF, GFCN
Harry Miller and S. J. Tao Jan. 1968 25 p
(Contract AT(30-1)-3661)
(NYO-3661-17) Avail: CFSTI

The subroutines SJTRF and GFCN for a computer program which calculates the fraction of wave functions outside a spherical well with various boundary conditions are described. NSA

N69-19327# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
PRODUCTION OF TWO AND MORE NEUTRAL π MESONS IN POSITIVE π–Xe INTERACTIONS AT 2.34 GeV/c
B. Slovinskii and Z. S. Strugal'skii 1968 27 p refs In RUSSIAN
(JINR-P1-4076) Avail: CFSTI

The results of the investigation of the π^0-meson characteristics, produced in π^+–Xe interactions at 2.34 GeV/c, are described. The average values of the longitudinal and transverse momentum components of π^0-mesons are given. The energy γ-quantum spectra and the effective mass distributions are presented. Author (NSA)

N69-19328# Australian National Univ., Canberra. Research School of Physical Sciences.
LEVEL WIDTHS IN THE COMPOUND NUCLEUS S 32 FROM THE REACTION P 31 (p,p_0)
J. Hallstroem and P. J. Dallimore [1968] 25 p refs
(ANU-P/418) Avail: CFSTI

The mean level width in the compound nucleus ^{32}S at an excitation energy of between 16.61 and 18.55 MeV has been investigated by the reaction $^{31}P(p,p_0)$. Excitation functions were measured in 10 keV steps from 8.00 to 10.00 MeV and at 15 angles between 30° and 160° (lab.). The excitation functions were analysed by the Fourier analysis method and there is evidence for a dependence of the mean level width on angle. The statistical model is unable to predict this angular dependence although it does predict the observed energy dependence of the mean level width.
Author

N69-19336# Laboratorie de Physique Theorique et des Hautes Energies, Orsay (France).
RADIATIVE CORRECTIONS TO $\phi \rightarrow K\bar{K}$ DECAY
E. Cremmer and M. Gourdin Dec. 1968 18 p refs
(TH-68/40) Avail: CFSTI

The electromagnetic corrections are computed for the $\phi \rightarrow K\bar{K}$ decay as the product of phase-space corrections due to the K^+ K^0 mass difference by radiative corrections in the second-order approximation. Author

N69-19350# Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.
MUON BIBLIOGRAPHY
Leon M. Golub and Kosta M. Tsipis Oct. 1968 37 p refs
(Contract AT(30-1)-2098)
(MIT-2098-466) Avail: CFSTI

A bibliography on the interactions and properties of muons covering the period 1963–1967, inclusive, is presented. NSA

N69-19354# Rome Univ. (Italy).
PHENOMENOLOGICAL LAGRANGIAN FOR NON-LEPTONIC WEAR INTERACTIONS
V. S. Vanyashin 13 May 1968 9 p refs *Its* Note No. 172
(NP-17688) Avail: CFSTI

A method of obtaining the weak non-leptonic phenomenological Lagrangian is proposed. Supplemented by the postulate of one-point approximation, the method leads to a good agreement with experimental data. Author (NSA)

N69-19363# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
TWO LEVEL RESONANCE FORMULAS AND THEIR APPLICATION TO THE CALCULATION OF THE EFFECTIVE RESONANCE INTEGRAL [FORMULE DI RESONANZA A DUE LIVELLI E LORO APPLICAZIONE AL CALCOLO DELL'INTEGRALE EFFETTIVO DI RISONANZA]
E. Menapace and M. Motta 1968 33 p refs In ITALIAN
(Contract EURATOM-017-66-7-RAPI)
(RT/FIMA-(68)2) Avail: CFSTI

A two-level formalism that takes into account resonance interference is outlined, and the computer program RESON which incorporates the formalism is briefly described. The program is written in FORTRAN for the IBM 7094. The results of sample calculations of the effective resonance integrals of ^{239}Pu and ^{233}U as functions of temperature are presented. NSA

N69-19366# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
ABSOLUTE MEASUREMENT OF ALPHA EMISSION AND SPONTANEOUS FISSION
Richard J. Brouns Washington NAS-NRC Sep. 1968 60 p refs
(Contract AT(45-1)-1830)
(NAS-NS-3112) Avail: CFSTI

A survey of techniques for absolute measurement of α emission and of spontaneous fission events is presented. Source preparation and calibration, counter design and calibration, and counting geometry are discussed. NSA

N69-19370# Institute of Nuclear Research, Krakow (Poland).
NUCLEAR GLORY EFFECT IN THE ELASTIC SCATTERING OF ALPHA PARTICLES ON Al-27, Si-28, S-32, K-39, Ca-40, Ti AND Co-59 NUCLEI
A. Bobrowska, K. Budzanowski, Jarczyk L. Grotowski, S. Micek, H. Niewodniczanski et al Jul. 1968 15 p refs
(INP-624) Avail: CFSTI

Angular distributions were measured for 27.5-MeV alpha particles scattered on ^{27}Al, ^{28}Si, ^{32}S, ^{39}K, ^{40}Ca, Ti, and ^{59}Co nuclei. The experimental data were fitted with the diffraction model in the region of forward angles and with the glory model for backward angles. Author (NSA)

N69-19373# Rome Univ. (Italy).
LOWER HADRON STATES CLASSIFICATION AND SU(3) TIMES SU(3) CHIRAL ALGEBRA APPROXIMATE SATURATION
F. Buccella, M. De Maria, and B. Tirozzi 10 Jul. 1968 20 p refs *Its* Note No. 177
(NP-17684) Avail: CFSTI

A classification scheme for hadrons is proposed, which fits well with the experimental π –N resonances. Under the hypothesis of SU(3) $\otimes$ SU(3) chiral algebra approximate saturation, G_A and $\alpha = D/D + F$ are evaluated in terms of the squares of the axial coupling constants; their value is in good agreement

with experiment. Further model dependent predictions are obtained for the mixing angles of the baryon wave function and for the branching ratios of the predicted strange resonances. The values of the mixing angles are in agreement with those expected from the e.m. structure of the nucleons. Author (NSA)

N69-19377# Australian National Univ., Canberra. Research School of Physical Sciences.
MULTI-LEVEL ANALYSIS OF THE P-WAVE ^{12}C-ALPHA ELASTIC SCATTERING PHASE SHIFT BETWEEN 9.16 AND 12.11 MeV
G. J. Clark [1968] 12 p refs
(ANU-P/422) Avail: CFSTI

As a multilevel analysis is required to fit the phase shifts across the full energy range, such an analysis is considered. In particular an alpha particle width is assigned to the 1$^-$ levels in O^{16} excitation energies of 7.116 MeV and 9.59 MeV. It is pointed out that a quantitative knowledge of the reduced width of the 7.116 MeV level is of importance in astrophysical calculations, since the level is suspected of having a large alpha particle reduced width and consequently, although energy bound by 46 keV, its influence on the production rate of O^{16} in stellar interiors may be substantial. Only the one-channel case of elastic scattering is examined, and the analytic form of the phase shift in terms of level parameters is given. A nonlinear least squares fitting program was used to fit the phases with this expression. The procedure consisted of finding a minimum in a multidimensional surface by assuming a quadratic approximation to the surface in the neighborhood of the minimum. Author

N69-19387# Adelaide Univ. (Australia). Dept. of Physics.
PHOTOELECTRON SPECTRA AND PARTIAL PHOTOIONIZATION CROSS SECTION FOR CARBON DIOXIDE
J. L. Bahr, A. J. Blake, J. H. Carver, and Vijay Kumar Jan. 1969 15 p refs
(Grant AF-AFOSR-1131-66)
(ADP-67) Avail: CFSTI

A photoelectron spectrometer has been used to determine partial photoionization cross sections for carbon dioxide for monochromatic incident radiations throughout the wavelength range 584–720 Å. Transitions to particular states of the CO_2^+ ion were identified by measuring the photoelectron energy. Transitions to the $^2\Pi_g$, $^2\Pi_u$, $^2\Sigma_u^+$ and $^2\Sigma_g^+$ states of CO_2^+ were observed at all photon energies for which they were energetically allowed. Partial cross sections for the production of each of these ionic states have been determined as a function of photon wavelength. Author

N69-19415# Chicago Univ., Ill. Dept. of Physics.
UM-ATOMIC HYPERFINE STRUCTURE IN THE K, L, AND M LINES OF U 238 AND Th 232
R. J. McKee (Ph.D. Thesis) [1968] 89 p refs
(EFINS-68-39) Avail: CFSTI

The mu-atomic hyperfine structure in the K, L, and M lines of U^{238} and Th^{232} was obtained using a large high-resolution Ge(Li) detector. The hyperfine structure is shown to be due to large deformations in these nuclei and arise from a dynamic electric quadrupole interaction between the muonic states and the lowest nuclear states. The measurements were interpreted using the Bohr–Mottelson rigid rotator model with a symmetry axis for the nucleus and taking into account the first and second rotational states. The charge distribution chosen was a Fermi type whose constant density shells are concentric ellipsoids of revolution of constant eccentricity. By numerically solving the Dirac equation it was possible to determine three parameters of the size and shape of the nuclear charge distribution. The intrinsic quadrupole moments were found to be $11.47 \pm 0.13 \times 10^{-24}$ cm^2 and $9.83 \pm 0.16 \times 10^{-24}$ cm^2 for U^{238} and Th^{232}, respectively, and in good agreement with other measurements. The deformation parameter β was found to be 0.244 ± 0.002 and 0.222 ± 0.003, respectively. Author

N69-19418# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf.
CALCULATED TRANSMISSION OF A CYLINDRICAL TUBE FOR LOW-ENERGY PROTONS UNDER THE INFLUENCE OF MAGNETIC AND ELECTRIC FIELDS, RESIDUAL GAS, NEUTRON AND GAMMA RADIATION [BERECHNUNG DER TRANSMISSION EINER ZYLINDRISCHEN ROEHRE FUER NJEDERENERGETISCHE PROTONEN UNTER DEM EINFLUSS VOM MAGNETISCHEN UND ELEKTRISCHEN FELDERN, RESTGAS, NEUTRONEN- UND GAMMASTRAHLUNG]
H. Paul and O. Nachtmann [1968] 36 p refs In GERMAN; ENGLISH summary
(SGAE-PH-72/1968) Avail: CFSTI

An evacuated tangential reactor beam tube was considered. Recoil protons from neutron decay originate near the core and pass two circular holes to reach an electric spectrometer, where the shape of the proton spectrum was measured with relative accuracy of 0.5%. Ambient magnetic fields were reduced by magnetic shielding. The magnetic field in a shielding tube whose permeability deteriorates in time due to neutron irradiation, and the electric field due to secondary electrons produced by gamma rays, were estimated. Space charge compensatiion was taken into account. The changes in transmission due to transverse and longitudinal magnetic and electric fields, and due to proton scattering in the residual gas produced by reactor irradiation were calculated. Author

N69-19443 Michigan Univ., Ann Arbor.
MOESSBAUER EFFECT IN K-40
Poh-Kun Tseng (Ph.D. Thesis) 1968 116 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-13419

The Mössbauer effect for the 29.4-keV gamma ray from K^{40} formed in the neutron capture reaction $K^{39}(n,\gamma)K^{40}$ is employed to determine the change in nuclear radius between the initial and final states of this γ-ray transition. A number of potassium compounds were used as targets, i.e., as γ-ray sources for Mössbauer measurements. These measurements were made at liquid nitrogen temperature. The results show that (a) the background and the recoilless fraction vary strongly from one case to another, (b) the quadrupole splitting and isomer shifts are small if not zero, and (c) the magnetic hyperfine splitting in the two antiferromagnetic perovskites investigated was not appreciable below their Curie temperatures. The recoilless fraction was measured as a function of temperature for a number of targets. By fitting the results to curves based on the Debye theory of solids, values for the Debye temperatures of these targets could be obtained. Dissert. Abstr.

N69-19447 Wisconsin Univ., Madison.
THE VECTOR ANALYZING POWER FOR (d,p) STRIPPING REACTIONS ON LIGHT AND INTERMEDIATE WEIGHT TARGET NUCLEI
Thomas Joseph Yule (Ph.D. Thesis) 1968 160 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-10939

Polarized deuterons have been used to initiate a number of stripping reactions for which the orbital angular momentum, l, and the total angular momentum transfer, j, are known. The vector analyzing power, $P_d(\theta)$, which is proportional to the left–right asymmetry when deuterons with pure vector polarization are incident, has been measured. The measured vector analyzing powers are compared with predictions based on the distorted-wave Born approximation. Effects of variations of optical parameters, and of inclusion of spin-orbit coupling, and of contributions from the nuclear interior are discussed. It can be concluded that, if one uses optical

potentials which fit the elastic-scattering data, the measured vector analyzing powers can be reproduced for intermediate weight target nuclei. Dissert. Abstr.

N69-19471# Princeton Univ., N. J. Palmer Physical Lab.
THE NUCLEAR SPINS AND MOMENTS OF Sb-119 AND Sb-115
Edward H. Rogers, Jr. (Ph.D. Thesis) Sep. 1968 67 p refs
(Contract AT(30-1)-937; NSF GP-579)
(PUC-937-333) Avail: CFSTI

The hyperfine structure (HFS) of 38-hr ^{119}Sb and 31-min ^{115}Sb was measured by the atomic-beam magnetic-resonance method. The isotopes were produced by the ^{119}Sn(p,n)^{119}Sb and the ^{115}Sn(p,2n) ^{115}Sb reactions in the Princeton University cyclotron with isotopically enriched targets. The HFS was studied in the off-line hybrid focusing beam apparatus. The values of the spins, HFS constants, and moments were determined. The least squares fit to the ^{119}Sb data gives g_I(Sb) = 1.97060(6). Author (NSA)

N69-19475# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
ATOMIC WAVE FUNCTIONS
K. B. Winterbon Nov. 1968 32 p refs
(AECL-3200) Avail: Atomic Energy of Can., Ltd., Chalk River: $1.00

The parameters of some of the atomic wave functions calculated by Clementi have been punched on cards. APEX programs exist for using these data in calculations. The ions are those with $Z \leq 29$, and $n_0 \leq n \leq Z + 1$, where n is the number of electrons, and n_0 the larger of Z-10 and 0. The explanatory text published with Clementi's tables is reprinted, with permission, and two tables of radii of the various wave functions are given. The radii are defined in different ways and are very different. Author

N69-19480# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Reaktorzentrum.
CHARGE SYMMETRICAL PAIRING CORRELATIONS FOR EVEN-EVEN NUCLEI WITH N = Z
E. Hiehs and Gerhard Hertenberger (Tech. Hochschule Wien) Sep. 1968 13 p refs Submitted for publication
(SGAE-PH-73/1968) Avail: CFSTI

A generalized Bogoliubov transformation has been introduced to include (L = 0, S = 1, T = 0) pairs of unlike particles in the ground state in addition to (L = 0, S = 0, T = 1) pairs for like particles. Assuming a charge symmetrical interaction for light nuclei with N = Z, it is shown that the number of independent parameters of transformation is reduced from four to three. As a consequence, the quantities characterizing the ground state, the density operator and the pairing tensor, assume the simplest possible form. The analytically soluble case of a single degenerate l shell is treated assuming an extreme pairing force. Author

N69-19485# Japan Atomic Energy Research Inst., Tokyo. Div. of Reactor Engineering.
MEASUREMENT OF NEUTRON SLOWING DOWN TIME IN HYDROGENEOUS MODERATORS
Yoshihiko Kaneko, Fujiyoshi Akino, Ryosuke Kurokawa, Kenji Kitadate, and Shigeyasu Sakamoto Oct. 1968 14 p refs
(JAERI-1168) Avail: CFSTI

The neutron slowing down times in light water, ice, paraffin, and santowax-R were obtained by measuring filter transmission rates as a function of time after injections of neutron bursts. The large flight time effects were taken into account experimentally. The results of the measurements of the slowing down times were presented. The measured slowing down times below 0.63 and 0.43 eV agreed well with theoretical values on the 0°K free gas model. However, the measured values below 0.20 eV are longer than the theoretical ones, which indicates the effect of the thermal agitation and chemical binding in the range of this energy. Author

N69-19491# Sandia Corp., Albuquerque, N. Mex.
ANALYTICAL APPROXIMATIONS FOR TOTAL PAIR-PRODUCTION CROSS SECTIONS
Frank Biggs and Ruth Lighthill Sep. 1968 22 p refs
(Contract AT(29-1)-789)
(SC-RR-68-619) Avail: CFSTI

Analytical approximations which are efficient for use in computer programs are given for total pair-production cross sections for atomic numbers $1 \leq Z \leq 100$ in the photon energy interval $1022.012 \leq E \leq 10^5$ keV. Graphs of cross sections and approximation parameters in tabular form are included. Author (NSA)

N69-19494# Minnesota Univ., Minneapolis.
NEGATIVE RHO-MESON NEGATIVE PION ENHANCEMENTS PRODUCED BY 2.3 GeV/c NEGATIVE PIONS IN DEUTERIUM
A. Benvenuti, E. Marquit, F. Oppenheimer, and J. C. Vanderveldе Apr. 1968 15 p refs Presented at the Meeting of the Am. Phys. Soc., Washington, D. C.
(Contract AT(11-1)-1764)
(COO-1764-17; CONF-680439-4) Avail: CFSTI

A total of 2405 events consisting of 877 4-prong and 1528 3-prong events fitting the reaction $\pi^- + d \rightarrow p_s + p + \pi^- + \pi^- + \pi^0$ that indicate $\rho^-\pi^-$ enchancements at 970 and 1080 MeV and possibly at 1160 MeV are reported. The enchancements seem to be associated with peripheral interactions. Attempts to investigate the possibility that these peaks are artificially enhanced by ρ selection and whether the peaks are reflections of $\Delta(1236)$ production are discussed. NSA

N69-19496# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Reaktorzentrum.
CREATION OF ISOTOPE FREE TARGETS INSIDE AN ELECTROMAGNETIC MASS SEPARATOR WITH IONIC BEAM RETARDATION [HERSTELLUNG ISOTOPENREINER TARGETS IM ELEKTROMAGNETISCHEN MASSENSEPARATOR DURCH IONENSTRAHLVERZOEGERUNG]
H. Wotke, T. Tortschanoff (Wien Univ.), and M. Hanganut (Inst. f. Atomphysik, Cluj, Rumaenien) 1968 14 p refs In GERMAN; ENGLISH summary Presented at Herbsttagung der Oesterr. Physik. Ges., Graz, Austria, 1968 Submitted for publication
(SGAE-PH-71/1968) Avail: CFSTI

After a short review of the methods for target preparation inside an electromagnetic isotope separator, the problem of target preparation with the beam retardation technique is discussed. For building up a monoisotopic layer on a carrier foil by direct impact of an ion beam, the self-sputtering coefficient has to be < 1. The energy dependance of the self-sputtering coefficient is discussed for the case of Pd 102. It proves that for building up targets, the Pd ions have to be retarded to energies < 300 eV. The experimental set-up and the results for Cu 63, Pd 102, and Gd 157 are described. Author

N69-19499# Georgia Inst. of Tech., Atlanta. School of Physics.
A LISTING OF PUBLICATIONS CONCERNING THE FORMATION AND DESTRUCTION OF EXCITED STATES BY COLLISIONS BETWEEN ATOMIC SYSTEMS
E. W. Thomas 31 Aug. 1968 48 p refs
(Contract AT(40-1)-591)
(ORO-2591-35; TR-2) Avail: CFSTI

Sources of experimental data on the formation and destruction of excited states by atom–atom and ion–atom collisions at impact

energies greater than 10 eV are listed. The list is divided into four sections as follows: (1) formation of excited atoms and ions by collision between two ground-state atomic or molecular structures under single-collision conditions; (2) differential scattering associated with the formation of an excited state; (3) collisional quenching of excited states under single-collision conditions; and (4) formation of excited states in a particle beam traversing a gas cell or plasma under multiple-collision conditions. Each section includes a tabulation of reactants, range of impact energy assessment of data accuracy, and reference. NSA

N69-19813 Tennessee Univ., Knoxville.
TWO-PROTON FINAL-STATE INTERACTIONS IN THE REACTIONS HELIUM-3(d, t)2p, d(HELIUM-3, t)2p, HELIUM-3(HELIUM-3, HELIUM-4)2p, AND p(HELIUM-3, d)2p
Bobby Joe Morton (Ph.D. Thesis) 1967 78 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-9819

The energy spectra of the observed particles for the reactions ^{3}He(d,t)2p, d(^{3}He,t)2p, ^{3}He(^{3}He, ^{4}He)2p, and p(^{3}He,d)2p were measured at forward angles using the 38 MeV deuteron beam and the 53 and 74 MeV ^{3}He beams. Each of the spectra were characterized by a peak in the high energy region corresponding to the two unobserved protons having a low relative energy. These peaks were attributed to the enhancement of the cross section in this energy region by the final state interaction of the two protons. The data were analyzed using the final state interaction theory of Watson and Migdal. This theory gave an adequate representation of the data for the reactions ^{3}He(d,t)2p and ^{3}He(^{3}He, ^{4}He)2p using the known proton–proton interaction. However, for the other reactions, d(^{3}He, t)2p and p(^{3}He, d)2p the observed peaks were much narrower than the theoretical predictions. For the reaction d(^{3}He, t)2p the narrower peak could be explained by assuming the primary reaction mechanism is a charge exchange process and calculating this effect using the impulse approximation. Dissert. Abstr.

N69-19849# Australian National Univ., Canberra. Dept. of Nuclear Physics.
THE SPIN OF THE 2.516 MeV LEVEL OF 140 Ce
H. Corda [1968] 3 p refs
(ANU-P/417) Avail: CFSTI

Arguments are presented to support the existence of a level at an excitation energy of 2.516 MeV with a spin of 4 for the lanthanum 140 decay. The mixing ratio of the 432.5 keV gamma ray depopulating this level is 0.032 + 0.0009. P.B.

N69-19879# Rome Univ. (Italy). Istituto di Fisica.
SINGLE-NEGATIVE-PION PHOTOPRODUCTION ON DEUTERIUM IN THE ENERGY RANGE (500 ÷ 800) MeV: PRELIMINARY RESULTS
M. Benieventano, F. de Notaristefani, P. Monacelli, L. Paoluzi, M. Severi et al 24 Jul. 1968 9 p Presented at Congr. of Vienna, 1968 /tr/ Nota Interna No. 182
(NP-17682) Avail: CFSTI

Preliminary results of measurements at the 1.1 GeV Frascati electron-synchrotron of the differential cross section of the single π^- photoproduction on deuterium $\gamma + n \rightarrow p + \pi^-$ for $(\theta_\pi)_{cm} = 90°$ and in the incident γ ray energy range of 500 to 800 MeV are reported. The experiment has been designed to add data in the rather poor energy region between the first and the second resonance. Author (NSA)

N69-19880# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
ON THE NUMBER CONSERVING TREATMENT OF THE PAIRING INTERACTION
G. Do Dang Aug. 1968 6 p refs
(IPNO/LA-68/24) Avail: CFSTI

A method of solution by iteration is given in the number-conserving treatment of the pairing interaction. It is local in the sense that a single nucleus is involved in the calculations. Author (NSA)

N69-19881# Syracuse Univ., N. Y. Dept. of Physics.
RESEARCH PROGRAM IN ELEMENTARY PARTICLE THEORY Progress Report, Period Ending 30 Nov. 1968
E. C. G. Sudarshan 30 Nov. 1968 57 p refs
(Contract AT(30-1)-3399)
(SU-1208-185; NYO-3399-185; PR-5) Avail: CFSTI

Research activities are briefly discussed including groups and infinite component wave equations, current algebras and chiral Lagrangians in strong, weak, and electromagnetic decays, dynamical models, theory of primary interactions, classical and quantum field theories, particles that move faster than light, and the kinematic structure of scattering amplitudes and decay widths. A list of recent publications is presented, and bibliographies and activities of the Syracuse University Theoretical Elementary Particle Physics Group are given. NSA

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N69-18439# Advisory Group for Aerospace Research and Development, Paris (France).
SELECTED TOPICS IN ELECTROFLUID DYNAMIC ENERGY CONVERSION
Maurice O. Lawson ed., and Frank Wattendorf, ed. Dec. 1968 260 p refs Presented at Electrofluid Dyn. Workshop Conf., Wright-Patterson AFB, Ohio, 23–25 May 1966 Supported in part by ARL
(AGARDOGRAPH-122) Avail: CFSTI

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N69-18440# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

THE ROLE OF ELECTROFLUID DYNAMICS IN THE FIELD OF DIRECT ENERGY CONVERSION

Hans von Ohain *In* AGARD Selected topics in Electrofluid Dyn. Energy Conversion Dec. 1968 p 5–13 (See N69-18439 08-25)

Avail: CFSTI

Although relatively unexplored among the many direct energy conversion processes, electrofluid dynamics (EFD) promises performance characteristics complementary to other processes in the overall energy conversion spectrum. The high potential, low current density electrical power of EFD devices has several natural applications. Moreover, virtually unlimited application possibilities will open up with the development of compact, inexpensive power conditioning apparatus. Author

N69-18441# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

ELECTROFLUID DYNAMIC ENERGY CONVERSION PROCESSES CHARACTERISTICS AND RESEARCH AREAS

Maurice O. Lawson *In* AGARD Selected topics in Electrofluid Dyn. Energy Conversion Dec. 1968 p 14–33 refs (See N69-18439 08-25)

Avail: CFSTI

The major characteristics of electrofluid dynamic generators are quite different from other direct energy conversion generators so that an important class of generators complementary to other generators is promised. Theoretical analyses have indicated the basic relationships between the various aerodynamic and electrical parameters. First order types of analyses have been made for different types of geometries, including the axisymmetric and two dimensional. More exact analyses remain to be done and experimental research efforts are in a rather early state. The experimental data obtained so far established reasonably good faith in the theoretically predicted trends and relationships. Much of this experimental effort has been concentrated in unipolar charge production, as the achievement of proper current levels is a prerequisite for a favorably operating generator. Other major research areas are electrode and channel geometries, high voltage and high voltage gradient insulation, properties of working fluids and suitable overall cycles for converting heat efficiently into electrical energy. Author

N69-18442# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

EFFECTS ON ELECTRODE GEOMETRY SIMILARITY AND SCALING LAWS IN EFD ENERGY CONVERSION PROCESSES. PART 1: FUNDAMENTAL CONSIDERATIONS

John A. Decaire *In* AGARD Selected topics in Electrofluid Dyn. Energy Conversion Dec. 1968 p 34–63 refs (See N69-18439 08-25)

Avail: CFSTI

Attractive performance characteristics are possible with viscous EFD processes which employ electrode and channel configurations corresponding to small aerodynamic drag losses, and which utilize pressurized gases of low molecular weight and high dielectric strength containing unipolar charged particles. Basically however, EFD processes are low pressure ratio processes inconsistent with a high overall conversion efficiency from heat into electricity. To overcome this incompatibility, ARL is exploring a special two-loop, two-fluid cycle. Successful operation of this concept requires the ability to seed the working medium with charge densities which are the highest possible consistent with fundamental channel limitations. A corona discharge is being investigated for charge seeding. Author

N69-18443# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

EFFECTS OF ELECTRODE GEOMETRY SIMILARITY AND SCALING LAWS IN EFD ENERGY CONVERSION PROCESSES. PART 2: EXPERIMENTAL RESULTS

James R. Wifall *In* AGARD Selected topics in Electrofluid Dyn. Energy Conversion Dec. 1968 p 64–95 (See N69-18439 08-25)

Avail: CFSTI

The ion currents generated with a sharp needle electrode increase linearly with increasing primary air pressure level up to about 40 atmospheres. The linear variation of ion current with total pressure is extended up to the maximum test pressure of 80 atmospheres by the use of the nailhead needles. Charged aerosol currents produced by condensation of water vapor around ions vary linearly with inlet total pressure levels up to about 30 atmospheres for both the sharp and nailhead needle electrodes. Above 30 atmospheres, the aerosol current fall off from a linear variation with total pressure. Future tests will investigate the high pressure aerosol current production.

N69-18444# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

WORKING MEDIA FOR ELECTROFLUID DYNAMIC GENERATORS

Michael Hawes *In* AGARD Selected topics in Electrofluid Dyn. Energy Conversion Dec. 1968 p 96–123 refs (See N69-18439 08-25)

Avail: CFSTI

Desirable characteristics of electrofluid dynamic working media with regard to power generation are reviewed. The dimensionless numbers of interest for power density and stage efficiency are cited. Since special mixtures of gases can provide better values of these dimensionless numbers than a single gas or vapor, an experimental program to determine dielectric strength of gas mixtures was conducted. Investigation results are given and comparisons with high pressure air as the working medium are made. Author

N69-18445# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

SOME ANALYTICAL TREATMENTS OF EFD PROCESSES

John E. Minardi *In* AGARD Selected Topics in Electrofluid Dyn. Energy Conversion Dec. 1968 p 124–179 refs (See N69-18439 08-25)

Avail: CFSTI

An approximate, analytic solution to the charge cloud growth in an axisymmetric electrofluid dynamic (EFD) generator is presented. With these formulae, a computer program is used to calculate the efficiency and power density over a wide range of parameters. A computer program for plane parallel electrodes that

includes the effects of charge spreading due to the electric field is also developed. Results show that electric field effects on the motion of charged colloids are negligible. Therefore, a numerical approach is developed to study complex electrode geometries of EFD generators considering the charge distribution to be known from fluid flow considerations. Author

N69-18446# Von Kaman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).
SOME REMARKS ON EFD ENERGY CONVERSION
Jean-Pierre Contzen *In* AGARD Selected Topics in Electrofluid Dyn. Energy Conversion Dec. 1968 p 180–186 refs (See N69-18439 08-25)
Avail: CFSTI

Some of the work carried out in Belgium in the field of fluid dynamics associated with electric or magnetic effects is briefly reviewed. The paper gives also some suggestions on possible applications of the EFD energy conversion process. Author

N69-18447*# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
DESIGN AND CONSTRUCTION OF A 3-MW MAGNETOGASDYNAMIC POWER GENERATION FACILITY AT THE UNIVERSITY OF TORONTO INSTITUTE OF AEROSPACE STUDIES
Stanley J. Townsend *In* AGARD Selected Topics in Electrofluid Dyn. Energy Conversion Dec. 1968 p 188–202 Supported in part by NASA, Defence Res. Board, and Ontario Dept. of Univ. Affairs (See N69-18439 08-25)
Avail: CFSTI CSCL 20I

The design features of a 3-MW, blow-down plasma facility are described. The primary aim has been to construct a facility having a large interaction channel to emphasize volume rather than surface effects. Independent control of flow velocity, static pressure, static gas temperature and magnetic field in the channel can be achieved over a wide range of operating conditions. Static pressures are achievable from a few Torr to over seven atmospheres, stagnation temperatures up to 2200–2500°K and magnetic fields up to 1.7 Tesla. Provision has been made for the additional radial or vortex-flow channels on a separate outlet of the main heater at a later date. Instrumentation of a constant-area channel, 5 cm × 10 cm × 120 cm, to measure the voltage and current characteristics of up to fifty electrode pairs has been completed. First runs are expected in the summer of 1968. Author

N69-18448# Technical Univ., Copenhagen (Denmark). Fluid Mechanics Dept.
PLASMA RESEARCH IN DENMARK
K. Refslund *In* AGARD Selected Topics in Electrofluid Dyn. Energy Conversion Dec. 1968 p 203–204 (See N69-18439 08-25)
Avail: CFSTI

Advanced plasma research in Denmark concentrated on the following three pieces of equipment: (1) a Q-machine for studying wave instabilities in plasmas. The parameters are measured in by Langmuir probes; (2) the a spark-shorting capacitor band over two parallel slabs of brass placed in vacuum for plasma production. Observations are made by smear camera and by mass spectrometer on the following: N_2, Ne, Ar, and He; and (3) a homopolar machine with a fast acting gas valve for studying rotating high energy plasmas. G.G.

N69-18449# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
COMMENTS ON ELECTROFLUID DYNAMICS AND RELATED RESEARCH IN FRANCE
Jean Fabri *In* AGARD Selected Topics in Electrofluid Dyn. Energy Conversion Dec. 1968 p 207–209 (See N69-18439 08-25)
Avail: CFSTI

In France various laboratories are working on plasmadynamics but the research is more of the magnetofluid dynamic type. Although the field of electrofluid dynamics is little developed, its potentialities seem very promising, in particular for space applications. Two French laboratories are working in the field of ion propulsion and this work is briefly described. Author

N69-18450# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Stuttgart (West Germany). Institut fuer Energiewandlung und Elektrische Antriebe.
THE ELECTROFLUID DYNAMIC ENERGY CONVERTER WITH SPACECHARGE NEUTRALIZATION
Eugen Knoernschild and Peter A. Schoeck *In* AGARD Selected topics in Electrofluid Dyn. Energy Conversion Dec. 1968 p 210–232 (See N69-18439 08-25)
Avail: CFSTI

This paper is concerned with a device which would eliminate the biggest disadvantage of the electrofluid dynamic (EFD) converter, namely its operation at very high voltage. The question, in which the first-named author was interested about ten years ago, was whether one could get rid of the space charge and design a converter which has its space charge neutralized, and therefore would operate at any voltage desired. In recent years this idea was taken up in the Hall accelerator which can be considered a space charge neutralized ion engine. After a short introduction to the various types of EFD energy converters, the basic difference between the space charge limited and the space charge neutralized operation is pointed out. The importance of a magnetic field on the mechanism of space charge neutralization is described. The equation of flow and of the forces which act in a space charge neutralized converter are derived. Test results which prove that space charge neutralization is possible, are presented. Author

N69-18451# Naples Univ. (Italy). Aerodynamics Inst.
COMMENTS ON ELECTROFLUID DYNAMICS AND RELATED RESEARCH IN ITALY
L. G. Napolitano *In* AGARD Selected Topics in Electrofluid Dyn. Energy Conversion Dec. 1968 p 234–243 refs (See N69-18439 08-25)
Avail: CFSTI

Although there is little research in electrofluid dynamics in Italy, there is growing interest. The author discusses broad interpretations of the complex phenomenology arising from the interaction between electric and fluid dynamic fields; and describes the approach of general studies that he and his group are doing. Author

N69-18452# British Embassy, Washington, D. C.
INTEREST AND PROGRESS IN ELECTROFLUID DYNAMICS AND RELATED RESEARCH IN ENGLAND
R. G. Voysey *In* AGARD Selected Topics in Electrofluid Dyn. Energy Conversion Dec. 1968 p 244–262 refs (See N69-18439 08-25)
Avail: CFSTI

In the United Kingdom there has been a small sustained interest in electrofluid dynamics over a long period of time, but the main effort has been on plasma research and MHD. Activities in these fields of the Central Electricity Generating Board; the Central Electricity Research Laboratories; the MHD Discussion Group; the Imperial College of Sciences; and the General Electric Company are discussed. There are by-products of such research of interest to electrofluid dynamics; and some work on EFD is continuing at Reading University and at the Rutherford High Energy Laboratory, Berkshire. Author

N69-18459 Tennessee Univ., Knoxville.
QUANTUM MECHANICAL THEORY OF NONLINEAR PLASMA PHENOMENA IN A MAGNETIC FIELD
Gary May Walters (Ph.D. Thesis) 1967 125 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-9838

Various types of nonlinear plasma phenomena in a strong magnetic field are considered by using a quantum mechanical description of the system. The model is the following: there is a distribution of energetic ions embedded in a relatively cold, infinite, neutralizing background. Here, the cold plasma produced by ionizing the background gas may be one or two orders of magnitude more dense than the energetic ions resulting from dissociation of the injected beam. The plasmon–particle and plasmon–plasmon processes are considered. The interaction of a particle with a plasma in a strong magnetic field is considered from the viewpoint of fluctuation theory. Quasilinear equations for the interaction of particles with circularly polarized waves are obtained. The interaction of light with a plasma in a magnetic field is considered from the viewpoint of fluctuations theory. The problem of emission and absorption of radiation by relativistic particles is considered. Dissert. Abstr.

N69-18462 Princeton Univ., N. J.
ON THE KINETIC THEORY OF STABLE AND WEAKLY UNSTABLE PLASMA
Andre L. Rogister (Ph.D. Thesis) 1968 112 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-9689

Within the framework of the Klimontovich formalism, a kinetic theory is presented of spatially homogeneous plasma in which discreteness effects and collective behavior are treated on a par. The theory is thus no longer Markoffian in the one-particle distribution functions $F^{(1)}$ alone, but is in the pair $|F^{(1)}, I_k|$ (with I_k the fluctuation spectrum of the waves). The kinetic description then embraces not only the Bogoliubov regime and the weakly unstable situation but it is also the first systematic theory which applies to those regimes which are dominated by collisional absorption of the waves and/or emission by wave-particle and particle–particle scattering (bremsstrahlung). With the introduction of original contour deformations, the equations also provide the continuous transition from instability to stability, so that an initially weakly unstable plasma can be followed all the way to thermal equilibrium. Dissert. Abstr.

N69-18492* Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRICAL EXPLODING OF FOIL
Yu. P. Kostochko et al. *In its* News of Inst. of Higher Learning, Phys., Vol. 10, No. 6 15 May 1968 p 1–4 refs (See N69-18491 08-34)
Avail: CFSTI

An experimental investigation was made of the acceleration of plasma created by the explosion of foil in air. Data on the characteristics of the current through the plasma were also obtained. Specimens of aluminum foil (0.001–0.005-mm, conically shaped) were placed between the axial (positive) electrode and the peripheral ring (negative) electrode diameter, 30 mm). The foil was exploded from an IM-3-100 capacitor battery at 6 kV. The radial propagation of the explosion was close to its theoretical rate. The plasma was accelerated along the axis of the cone during the time of the explosion, which in the experiments was 25 to 30 μs. The plasma jet is subject to a pinch, which augments the acceleration due to magnetic effects that induce local currents on the surface in a direction opposite that of the main stream. Another accelerating factor is the cumulation of foil explosion products, the effects of which were most pronounced with sharper cones. Author

N69-18533 Case Western Reserve Univ., Cleveland, Ohio.
AN INVESTIGATION INTO THE DOWNSTREAM PLASMA STATE IN HYDROGEN PRODUCED BY AN ELECTROMAGNETIC COAXIAL SHOCK TUBE
Roderic Mac Donald Scott (Ph.D. Thesis) 1967 88 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-10182

A series of investigation was carried out on an electromagnetic coaxial shock tube to improve our understanding of its performance. In these investigations the downstream plasma state was determined for a front traveling through unionized hydrogen at 3.86 cm/μsec. The resulting shock wave moved into a medium which had an initial gas pressure of 300 milliton and an oblique bias magnetic field of about 19°. The measured post shock conditions were determined to be that the electron temperature was 6.0 × 10^4 °K, the density jump was 1.5, and the post shock azimuthal field was 2.6 kilogauss. These results were found to be at variance with available theories. The discrepancy was the worst for the temperature which was three to four times higher than the classical predictions. The anomaly is attributed to the onset of turbulence. Several suggestions based on the dynamics of the shock tube are made to extend the range of operation of this type of instrument. Dissert. Abstr.

N69-18559 Michigan Univ., Ann Arbor.
PHOTON SCATTERING FROM QUANTUM PLASMAS
John Henry Schaibly (Ph.D. Thesis) 1968 99 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-13398

In this dissertation the cross section for scattering of photons from plasmas is derived by means of an application of quantum perturbation theory to a many body system. The analysis formulates the cross section in the Born approximation relating it to multiple time correlation functions which are further analyzed within the context of the random phase approximation for systems in various field-free and magnetic field configurations. The most important results obtained here are a systematic derivation of the dependence of photon scattering in plasmas on particle interactions in quantum systems immersed in a magnetic field, and the existence of Rayleigh-like scattering from the bound states existing in a magnetic field which is neglected in a classical theory. The primary effect of this additional scattering process is a depolarization of the incident radiation. Dissert. Abstr.

N69-18563 California Univ., San Diego.
NUCLEAR MAGNETIC RELAXATION IN HIGH MAGNETIC FIELDS BY PLASMA MODES AND IMPURITY STATES
Gregory Albert Benford (Ph.D. Thesis) 1967 148 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-10130

The modes of a quantum plasma in a magnetic field are calculated and attention focused on waves which propagate nearly perpendicular to H_0. We consider the nonlinear coupling of plasma waves and their interaction with nuclear spins through the electric quadrupole moment, as in the phonon case. A resonance in $1/T_1$ is predicted for which the peak height is much less sensitive to temperature. However this explanation is inconsistent with the present estimates of the damping of plasma oscillations in InSb. An alternative explanation is advanced, showing that a new impurity density of states appears as H_0 increases. This density of states is due to binding of two electrons by a singly charged impurity. This model, which simply makes use of the new density of states directly in the Korringa relation, is found to be consistent with all of the present experimental data. Dissert. Abstr.

N69-18581 Pennsylvania State Univ., University Park.
ON CIRCULATION AND RELATED TOPICS IN RELATIVISTIC MAGNETOHYDRODYNAMICS
Hon-fai Yau (Ph.D. Thesis) 1967 84 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-8762

This is an investigation of the relativistic effects of two related mathematical problems. The first one is the condition of the constancy of circulation in a relativistic infinitely conducting fluid in the presence of an electromagnetic field. Secondly the frozen-in properties of the magnetic field lines in the relativistic MHD problems are examined. In order to simplify the mathematical complications a simple model is employed of ideal fluid which is nonviscous, nonheat conducting and infinitely conducting the first part of the thesis. The 4-dimensional relativistic circulation is defined by equation, but only the 3-dimensional relativistic circulation is considered in detail because it bears more physical meaning.
Dissert. Abstr.

N69-18701*# Scripta Technica, Inc., Washington, D. C.
AN ELECTROSTATIC ANALYZER FOR MEASURING THE ENERGY OF IONS AND ELECTRONS FROM HOT PLASMAS [EIN ELEKTROSTATISCHER ANALYSATOR ZUR MESSUNG DER ENERGIE VON IONEN UND ELEKTRONEN AUS HEISSEN PLASMEN]
H. Niedermeyer Washington NASA Nov. 1968 46 p refs Transl. into ENGLISH from Inst. fuer Plasmaphysik Rept. IPP 1/66, Jun. 1967, p 66
(Contract NASw-1694)
(NASA-TT-F-11924; IPP-1/66) Avail: CFSTI CSCL 20I

An electrostatic energy analyzer for recording the energy spectrum of plasma particles (electrons and positive ions) in the range of 10 eV to a few 10 keV is described. The resolution of the cylindrical capacitor used as energy filter can be set between 1% and 3%. The transmitted particle current is measured with a scintillation detector sensitive to ions or electrons depending on the applied electrode voltages (ions produce secondary electrons, which are detected with the scintillator). For a time resolution of 5 ns a particle current of 10^{-7} A is measured with a statistic error of 2%. The sensitivity of the detector was calibrated absolutely with an electron and ion beam respectively. Plasma particles are admitted to the analyzer through a highly evacuated, magnetically shielded tube system that can be placed to within a few centimeters of a high temperature plasma. The calibration method and the electron and ion sources used for calibration are also described.
Author

N69-18709# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
THE INFLUENCE OF RELAXATION EFFECTS ON SPECTROSCOPIC TEMPERATURE MEASUREMENTS OF A STATIONARY HYDROGEN ARC IN AN AXIAL MAGNETIC FIELD [EINFLUSS VON RELAXATIONSERSCHEINUNGEN AUF DIE SPEKTROSKOPISCHE TEMPERATURMESSUNG EINES STATIONAEREN WASSERSTOFFLICHTBOGENS IM MAGNETFELD]
K. Tichmann Jul. 1968 55 p refs In GERMAN; ENGLISH summary
(IPP-3/77) Avail: CFSTI

The radial temperature distribution in a 2400 Amp hydrogen arc in a 35 kG axial magnetic field was measured spectroscopically. Temperatures in the range 20,000°K to 60,000°K were determined from the ratio of the intensity of the Balmer H_β line to the neighbouring continuum. For measuring temperatures above 40,000°K a small quantity of helium was added to the hydrogen. The temperature was then determined from the intensity ratio of a He II to a He I line using the corona equation as the ionization equation between He^{++} and He^{+}. At temperatures at which the two measuring methods could be used simultaneously there were strong deviations between the results. These deviations were attributed to radial flow of helium ions. It is concluded that temperature can be satisfactorily determined from measurements of the line intensity ratio He II/He I using the corona formula only at magnetic fields above 120 kG, at the arc axis.
Author (ESRO)

N69-18710# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).
RADIATION LOSSES OF A HIGH DENSITY Z-PINCH [DIE STRAHLUNGSVERLUSTE EINES Z-PINCHES HOHER DICHTE]
M. Kaufmann Aug. 1968 55 p refs In GERMAN; ENGLISH summary
(IPP-1/86) Avail: CFSTI

The radiative losses of a high density z-pinch were investigated experimentally. When the compressed column had reached a temperature of 10 eV, the radiative losses were determined by a special measuring method in which the vacuum UV radiation was resolved in time and recorded by means of an open photocell. This method also involved absolute, but time integrated measurement of the radiation by means of a thermopile. It was found that the major part of the internal energy of the plasma was lost by radiation.
Author (ESRO)

N69-18716 New York Univ., N. Y.
STABILITY OF THE GUIDING CENTER PLASMA
David Brian Nelson (Ph.D. Thesis) 1967 45 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-10081

Using a variational principle for the guiding center plasma, the implications for absolute stability of local stability plus interchange stability are examined. The geometry chosen for this analysis is open ended, with magnetic lines free to interchange at the ends. The method of analysis uses the fact that any admissible variation away from an equilibrium can be decomposed into an interchange plus a variation which vanishes at one end of the plasma domain. Then the second variation, as a quadratic form, is accordingly separated into three terms which are examined separately. We find that if the spatial magnetic field and plasma gradients are sufficiently small, then local stability plus a strong form of interchange stability do suffice for absolute variational stability. This strong form is actually weaker than most of the sufficient conditions for interchange stability which have previously been derived. It is shown that lengthening a stable plasma does not result in instability, whether or not the ends are tied.
Dissert. Abstr.

N69-18721 Yale Univ., New Haven, Conn.
MICROWAVE CONDUCTIVITY OF PLASMAS RELATIVISTIC REFINEMENTS AND COLLECTIVE THEORY
Dae Mann Kim (Ph.D. Thesis) 1967 156 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-5170

In this thesis some aspects of the interaction of radiation with fully ionized plasmas are studied. The first part consists of a general survey of the problem. Here we introduce the basic techniques needed for our work, and review the underlying principles. In the second part we study a relativistic plasma and obtain some refinements on the expression for the conductivity by means of kinetic theory. The final part of the thesis is concerned with the collective motions of charged particles. The static as well as the dynamic shielding of the particles and their effect on the conductivity expression are investigated via the diagram technique of Prigogine.
Dissert. Abstr.

N69-18723# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
PLASMA LOSSES IN A TOROIDAL THETA PINCH WITH SUPERPOSED HEXAPOLE

J. Junker and W. Lotz May 1968 32 p refs
(IPP-1/82) Avail: CFSTI

The plasma loss rates are determined by measuring particle density, temperature and plasma radius and are compared with models which account for cusp losses, resistive losses, and Bohm diffusion. Measured loss rates are consistent with those expected from cusp losses with a cusp slit-width of one ion gyro-radius. Above electron temperatures of 20 eV, resistive losses are negligible. Bohm diffusion is not consistent with the measurements, but is of the same order of magnitude. The machine is now being converted into a $l=3$ 'fast stellarator' configuration. Author (ESRO)

N69-18725# Kernforschungsanlage, Juelich (West Germany). Inst. fur Plasmaphysik.
THE ENGINEERING OF A HELICAL HARD CORE THETAPINCH EXPERIMENT (TESI)
F. J. Friedrich, W. Kohlhaas, and C. Stickelmann Jun. 1968 16 p refs Sponsored in part by EURATOM
(JUL-538-PP) Avail: CFSTI

A fast Thetapinch experiment has been modified by inserting a helical hard core on its axis. This coil consists of 12 parallel wires imbedded in a glass-fiber reinforced epoxy rod. At both extremities, the wires are parallel to the axis of the rod. In the central part, over 30 cm, they are wound with a pitch angle of 45°. By this arrangement it should be possible to produce a compact toroidal plasma and to study its confinement time and stability. Initially, the diameter of the Thetapinch coil will be 20 cm and that of the hard core 4.5 cm. The Thetapinch coil and the hard core are energized by a 40 kV, 15 kJ capacitor bank and a 60 kV, 21 kJ bank, respectively. The design of the hard core and of the 60 kV capacitor bank will be reported. Author (ESRO)

N69-18744# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
SPECTROSCOPIC MEASUREMENTS OF ABSOLUTE DENSITY DISTRIBUTION OF THE ATOMIC BEAM OF A Q-DEVICE
M. Hashmi and A. J. van der Houven van Oordt Mar. 1968 15 p
(IPP-2/86) Avail: CFSTI

The absolute density distribution of a finely collimated atomic beam of barium is measured by resonance fluorescence scattering of light. Author (ESRO)

N69-18769*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GYRO-SYNCHROTRON EMISSION AND ABSORPTION IN A MAGNETOACTIVE PLASMA
Reuven Ramaty Jan. 1969 54 p refs
(NASA-TM-X-63454; X-611-69-23) Avail: CFSTI CSCL 20I

The intensity, spectrum, and polarization of gyro-synchrotron radiation from an arbitrary distribution of electrons in a magnetoactive plasma are calculated. These calculations are based on detailed theories of gyro-synchrotron emission and absorption as well as on the equations of radiation transfer in the limit of large Faraday rotation. By performing extensive numerical calculations, for both isotropic and anisotropic electron distributions, the influence of reabsorption and the Razin effect on the spectrum and polarization of the radiation were investigated. Using the same formalism and calculations, the possibility of negative absorption in an anisotropic gyro-synchrotron source was investigated. Author

N69-18775# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
SOLUTION OF THE LINEAR PORTION OF DUPREE'S PERTURBATION THEORY FOR PLASMA TURBULENCE
H. Gratzl Mar. 1968 34 p refs
(IPP-6/65) Avail: CFSTI

For a turbulent plasma Dupree has given equations differing somewhat from the quasilinear ones, using for integration particle orbits perturbed by the fields. For a small diffusion coefficient the special assumptions made by Dupree no longer hold, e.g. to maintain energy conservation. In case of a very large diffusion coefficient, however, first considered by Dupree the approximation expansion is degraded if time variation of the distribution function is still taken into account. As shown by Orzag and Kraichnann, the initial value problem can be treated by an extension of Dupree's equations. ESRO

N69-18813# Royal Inst. of Tech., Stockholm (Sweden). Plasma Physics Div.
PARALLEL ELECTRIC FIELDS IN LOW-DENSITY PLASMA
Hans Persson Sep. 1968 39 p refs
(Rept.-68-18) Avail: CFSTI

A number of experimental and theoretical results, concerning quasistatic electric fields E along the magnetic field in low-density plasma, are summarized and discussed, and a couple of new results are included. Three types of E are considered, namely fields related to longitudinal magnetic gradients, fields due to wave-particle interaction, and electric fields in sheaths. Stationary, monotonic potentials in sheaths in Vlasov plasma are analyzed. ESRO

N69-18816# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
ELECTROSTATIC INSTABILITIES AND THE THREE ADIABATIC INVARIANTS OF CHARGED PARTICLES [ELEKTROSTATISCHE INSTABILITAETEN UND DIE DREI ADIABATISCHEN INVARIANTEN GELADENER TEILCHEN]
Günther Otto Spies Jun. 1968 72 p refs In GERMAN; ENGLISH summary
(IPP-6/66) Avail: CFSTI

The theory of adiabatic invariants of charged particles is developed starting from the nearly periodic, autonomous canonical systems of M. Kruskal, which is generalized to be applicable to time-dependent motion of a charged particle in an electromagnetic field. It is proved that in a static magnetic field a necessary condition for constancy of the longitudinal invariant that the zeroth-order electric field vanishes. For studying the stability of singly connected equilibrium configurations of collisionless plasmas, slowly varying electromagnetic disturbances are considered, from which a sufficient stability criterion, viz., monotony conditions for the equilibrium distribution functions are derived. Author (ESRO)

N69-18831# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).
ION HEATING IN A VERY FAST THETA PINCH [DIE ENERGIEAUFNAHME DER IONEN IN EINEM SEHR SCHNELLEN THETA-PINCH]
R. Wilhelm Aug. 1968 65 p refs In GERMAN; ENGLISH summary
(IPP-1/87) Avail: CFSTI

In a theta pinch with an extremely fast rising magnetic field, a strong compression wave is produced in an initially fieldless low-density deuterium plasma. Assuming simple plasma models, already during the implosion of the plasma, a high-energy gain of the ions is expected. In agreement with these calculations a mean ion energy of 1–2 keV has been found from the first neutron emission at the end of the implosion. Decreasing the initial pressure does not cause any further increase of the achieved ion energy. This limitation of the ion heating is explained by a strong broadening of the current carrying layer at low densities which is observed by magnetic probe measurements. In the adiabatic compression, the mean ion energy attains values of several keV. During the first part of this phase the energy distribution of the ions is found to be essentially anisotropic and monoenergetic rather than Maxwellian. Author (ESRO)

N69-18835# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).

INSTITUTE FOR PLASMA PHYSICS Annual Report, 1966 [JAHRESBERICHT 1966 DES INSTITUTES FUER PLASMAPHYSIK, MUENCHEN/GARCHING]

[1967] 134 p refs In GERMAN

Avail: CFSTI

This report contains papers on linear and toroidal theta pinch, hot plasmas, toroidal inclusion, thermal plasmas, ambipolar diffusion, ion cyclotron waves, surface problems, plasma heating, laser-generated plasmas, shock waves and plasma injection, plasma dynamics, microwave problems, plasma equilibrium, electromagnetic radiation, microscopic theory, numerical computer analysis and problems of experimental technology. ESRO

N69-18845# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

MEASUREMENT OF BARIUM VAPOR DENSITY

E. Hinnov and W. Ohlendorf Jul. 1968 18 p refs

(IPP-2/71) Avail: CFSTI

The density of atomic barium emitted from a small aperture in a uniformly heated stainless-steel oven has been measured by the method of resonance fluorescence. The range of the oven temperature was 730°-1200°K. At lower densities, the resonance transition $6\,s^2S_6\,s\,p^1P$ was used for the density measurements, at higher densities the forbidden transition $6s\,^2S \rightarrow 6pSd\,^3XP$ or ^3D, followed by emission through the allowed transitions to $6s5d\,^3D$. From the measured spatial distribution of the density above the aperture, the equilibrium vapor density in the oven was deduced. In addition to the barium density, the measurements yielded some information on the atomic transitions employed, generally confirming previous knowledge in this matter. Author (ESRO)

N69-18880# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

ON THE INFLUENCE OF LATTICE STRUCTURE AND TEMPERATURE ON THE BACKSCATTERING OF PROTONS FROM COPPER IN THE ENERGY RANGE 40 TO 120 keV [UEBER DEN EINFLUSS DER GITTERSTRUKTUR UND TEMPERATUR AUF DIE RUECKSTREUUNG VON PROTONEN AN KUPFER IM ENERGIEBEREICH VON 40 BIS 120 keV]

R. Behrisch (Ph.D. Thesis — Munich Univ.) Jun. 1968 36 p refs In GERMAN; ENGLISH summary

(IPP-2/68) Avail: CFSTI

The backscattering of protons with energies of 40 to 120 keV from a Cu monocrystal is treated. The energy and angular distribution of the backscattered hydrogen atoms were measured with a silicon surface barrier counter with an energy resolution of 7.5 keV FWHM. Towards low energies the energy distribution of the backscattered hydrogen atoms shows a strong rise. The region of the shadow minimum in the <100> direction was both recorded with a photographic plate and measured with the counter, and diagrams of lines of equal intensity were drawn. The exact shapes of the minima agree only approximately with calculated curves. The calculations do not take into account the fact that the ions undergo many angular deflections on passing through the lattice. Author (ESRO)

N69-18890 Princeton Univ., N. J.

KINETIC THEORY OF THE CLASSICAL EQUILIBRIUM PLASMA MEDIUM

Frederick Drach Tappert (Ph.D. Thesis) 1967 214 p

Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 68-8967

The methods of kinetic theory are used to study a classical, Hamiltonian system consisting of N electrons (point charges) imbedded in a uniform neutralizing background of positive charge in the bulk limit ($N \rightarrow \infty$, $V \rightarrow \infty$, $n = N/V$ = const.), assuming that the plasma expansion parameter ϵ is small. First, the static properties of the equilibrium plasma medium are investigated on the basis of the Gibbs canonical distribution and the BBGKY hierarchy equations for the correlation functions. An expansion of the correlation functions in powers of ϵ is non-uniformly convergent, failing at both small (the "inner region") and large (the "outer region") interparticle separations. Application of the method of matched asymptotic expansions solves this difficulty and leads to a correction of the Debye-Hückel screening length of order ϵ. Dissert. Abstr.

N69-18894 Princeton Univ., N. J.

EXPERIMENTAL DETERMINATION OF ELECTRON IMPACT IONIZATION RATE COEFFICIENTS FOR NEON IONS

Donald Lee Mickey (Ph.D. Thesis) 1968 66 p

Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 68-9688

Rate coefficients for collisional ionization of the ions Ne^+ through Ne^{6+} were measured in several ohmically heated hydrogen discharges of the C stellarator, with 0.25–4% neon added. The electron densities were between 10^{12} and $4 \times 10^{13}\,cm^{-3}$, electron temperatures determined from the electrical conductivity of the plasma were between 8 and 100 eV. Neon ion densities were obtained as a function of time in the discharge from measurements of the intensities of resonance multiplets in each ion, on the basis of an assumed energy dependence for the excitation cross sections. The magnitudes of the excitation cross sections were determined from approximate oscillator strengths for the transitions, adjusted to give agreement with the known total neon density and with predicted populations of metastable terms. Dissert. Abstr.

N69-18998 New York Univ., N. Y.

SCATTERING OF PARTICLE BEAMS FROM PLASMAS

Byron B. Goldstein (Ph.D. Thesis) 1967 151 p

Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-10060

The probability of detecting collective effects in laboratory plasmas by the use of atomic beam scattering experiments is investigated. It is found that the scattering of light atoms from dense plasmas, composed of electrons and heavy ions, offers the best possibility for the detection of such effects. In the impulse approximation, the differential cross for scattering of spin 1/2 atoms from a plasma is obtained. This cross section is given in terms of the atom–ion and atom–electron two body scattering amplitudes and in terms of integrals over the dynamic form factors of the plasma. The electron incoherent dynamic form factor is obtained from the electron coherent dynamic form factor by use of the convolution approximation. The convolution approximation leads directly to the prediction that the spin-flip cross section will be enhanced as θ goes to zero. Dissert. Abstr.

N69-19067# Cornell Aeronautical Lab. Inc., Buffalo, N. Y.

THEORY OF CONVECTION-CONDUCTION DOMINATED ELECTROSTATIC PROBES: NUMERICAL SOLUTION OF THE TWO-DIMENSIONAL FLAT PLATE PROBLEM

John K. Dukowicz Jan. 1969 76 p refs

(CAL-RA-2641-Y-1) Avail: Issuing Activity

A continuum theory of electrostatic probe operation in a flowing plasma is developed, suitable whenever the condition $Re\lambda_D\,Sc(ex_0/kT)^{1/2} >> 1$ is valid for both electrons and ions. Specifically, the theory neglects diffusion and viscosity effects in comparison with the effects of mass motion and mobility in the electric field. This report restricts itself to the simplest geometry—that of the semi-infinite flat plate in plane parallel flow. The emphasis is placed on developing the numerical techniques necessary for the solution of the problem, gathering experience in the behavior of the mathematical model, and determining the limitations of the numerical technique. Numerical results are presented for a limited parametric study of an ion-attracting probe. The results presented

include potential distributions, sheath shapes, ion trajectories, and the total current collected as a function of probe length and applied potential. It is found that the collected current is remarkably insensitive to the electron mobility parameter, and that the current-voltage characteristics apparently possess a common envelope of simple form, distinct from the asymptotic theory of deBoer. Author

N69-19078# Pennsylvania Univ., Philadelphia. The Towne School of Civil and Mechanical Engineering.

ION AND ELECTRON SATURATION CURRENTS TO ELLIPSOIDAL LANGMUIR PROBES IN A SLIGHTLY IONIZED, COLLISION-DOMINATED PLASMA WITH UNIFORM MAGNETIC FIELD

Ira M. Cohen Nov. 1968 25 p refs
(Grant NSF GK-2281)
(Rept-2281/1) Avail: CFSTI

Electrostatic probe theory for a slightly ionized, collision-dominated plasma is extended, in the sense of problem formulation, to allow for the presence of a uniform magnetic field. Provided that the Debye length is very much smaller than a probe dimension, ion and electron currents to the probe saturate, respectively, at large negative and positive probe bias with respect to the plasma potential. It is shown that it is not necessary to go through a lengthy asymptotic analysis to compute the saturation currents. Ion and electron saturation currents to ellipsoids of revolution inclined at an arbitrary angle to the magnetic field are given in compact form in terms of common elliptic functions. Author

N69-19107# Southwest Research Inst., San Antonio, Tex.

ON MHD FLOW IN A RECTANGULAR DUCT OF ARBITRARY CONDUCTIVITY FOR ARBITRARY HARTMAN NUMBER

W. H. Chu 30 Oct. 1968 20 p refs
Avail: Issuing Activity

The titled problem was solved by a modified Fourier method so that boundary conditions can be fulfilled. The flow parameter, induced magnetic induction, and current were obtained for various conduction parameters and Hartman numbers. For zero and infinite conduction parameters, the calculated values are in good agreement with known theoretical results. Author

N69-19131*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

LABORATORY SIMULATION OF SOLAR WIND–EARTH INTERACTION

Donald L. Chubb Washington Feb. 1969 12 p refs
(NASA-TM-X-1738) Avail: CFSTI CSCL 04A

A laboratory simulation experiment of the interaction of the solar wind and the earth's magnetic field is being conducted. The plasma flow is produced by an MPD arc and a magnetic dipole is used to simulate the earth's magnetic field. The initial investigations of the stagnation region of the flow show a rapid rise in the plasma potential. The magnetic field in this region is also altered from the dipole type behavior it exhibits when no flow exists. This region of change is plasma potential and magnetic field has a thickness characterized by the electron cyclotron radius. It appears to be a merging together of a collisionless deceleration and stagnation of the flow. However, whether or not a collisionless shock wave exists has not been conclusively demonstrated. Author

N69-19182# Miami Univ., Coral Gables, Fla. Dept. of Physics.

THE HELIOS RESEARCH PROGRAM

Harry S. Robertson Oct. 1968 111 p refs *Its* Plasma Phys. Bull., Vol. 8, No. 3, Oct. 1968
(Contract AT(40-1)-2454)
(MIAPH-PL-68.7; ORO-2454-11) Avail: CFSTI

A comprehensive experimental and theoretical program is proposed, exploring a combination of new and standard techniques for containing and heating steady-state plasmas in open-ended geometry. The principal vehicle proposed for this research is the Helios (for Heated Lithium Ion System) facility, in which a contact-ionized lithium plasma is to be heated by a stochastic electric field and contained in a minimum-B, boundary-stabilized cage. All possible free-energy sources are to be eliminated, for improved stabilization, and suppression of instability growth is further expected as a side benefit of the stochastic heating process. Experiments are proposed to test, among other things, the value of the stochastic field in suppressing instabilities and in heating the plasma uniformly, the conjecture that stable, steady-state confinement requires ambipolarity, and further effects of the boundary conditions on heating, containment, and stability. Author (NSA)

N69-19209# Commissariat a l'Energie Atomique, Fontenay-Aux-Roses (France). Centre d'Etudes Nucleaires.

LASER-PRODUCED PLASMA FROM A LiH SOLID PELLET

P. E. Faugeras, M. Mattioli, and R. Papoular [1968] 8 p refs Presented at the AIAA Conf. on Fluid and Plasma Dyn., Los Angeles, 24–26 Jun. 1968
(CEA-CONF-1010; CONF-680616-2) Avail: CFSTI

A high-density plasma is formed by interaction of a Nd laser beam with a LiH pellet electrodynamically suspended in vacuum. The plasma has been studied by means of photomultipliers and charge collectors. Measurements of the light emitted by the plasma have been performed, particular consideration having been given to the effects obtained by varying the laser energy. A comparison with the predictions of the current theory of the laser plasma interaction shows some disagreement, the possible origins of which are discussed. By means of the charge collectors, one was led to the determination of the freely expanding plasma density profile and to an estimation of the initial mean energy per particle; one was led, as well, to an estimation of the extent to which the plasma recombines during expansion. In uniform magnetic field, up to kG, most of the plasma escapes along the field lines; there is some evidence that a dense and warm plasma is radially confined. Author (NSA)

N69-19222# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.

KINETIC THEORY OF HIGHLY NONEQUILIBRIUM PLASMAS 2: ELECTRON ENERGY EQUATION

James T. Yen Jan. 1969 8 p refs Submitted for publication
(RE-354J) Avail: CFSTI

An electron energy equation different from the usual equation is found for highly nonequilibrium plasmas where the electron diffusion velocity and its associated current density are not small and where the electron temperature may be enhanced. Author

N69-19227# Stichting Voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands). Instituut Voor Plasma-Fysica.

CONFINEMENT OF PLASMA WITH HIGH FREQUENCY FIELDS

H. J. L. Hagebeuk (Ph.D. Thesis—Utrecht Univ.) Oct. 1968 82 p refs
(NP-17707; Rept-68-46) Avail: CFSTI

A description is given of a highly ionized hydrogen plasma in a strong uniform magnetostatic field. On one side the axial leak of electrons is suppressed by the time-average force exerted by a nonuniform hf electric field which is mainly parallel to the magnetostatic field and which decreases towards the plasma. On the other side the electrons are confined by an electrostatic field. The confinement of electrons gives rise to a negative space charge potential which confines the ions. From numerically calculated orbits of electrons which are reflected nonadiabatically by the hf

field an expression is derived for the energy gain. It can be of the same order of magnitude as the energy gained by electrons in collisions with heavy particles in the hf field region. The influence of the energy gain on the energy distribution of electrons is calculated. Author (NSA)

N69-19230# Academy of Sciences (USSR), Moscow.
ELECTROMAGNETIC PROPERTIES OF TURBULLENT PLASMA
V. N. Tsytovich 1968 99 p refs In RUSSIAN
(NP-17705) Avail: CFSTI

The main problem of the theoretical study of the electromagnetic properties of turbulent plasma lies in the calculation of the tensor of dielectric penetrability of the system, depending on the frequency and wave number of the perturbing electromagnetic field. Current approaches of investigation in this area are reviewed, considering not only specific concrete applications, such as drift instability, but also overall theoretical aspects of the problem, beyond the usual assumption of a weak action of the turbulence on the electromagnetic properties of the plasma. It is pointed out that plasmas encountered in nature, such as cosmic plasma, are usually turbulent; their study may throw some light on the origin of magnetic fields in the Universe. The conclusions reached are expected to be of interest not only for the study of the passage of weak electromagnetic waves through cosmic plasma but also for developing new diagnostic methods for instabilities. NSA

N69-19307# Utah Univ., Salt Lake City. Microwave Device and Physical Electronics Lab.
THE EFFECT OF A MAGNETIC FIELD ON DISCHARGE PLASMAS AND ION LASERS
John H. Keller and Richard W. Grow Nov. 1968 141 p refs
(Grants NSF GK-29; NSF GK-1644)
(NSF-19; UTEC-MD-68-102) Avail: Issuing Activity

Described are theoretical effects of both uniform and nonuniform magnetic fields on discharge plasmas and ion lasers. These theories include a comprehensive derivation of nonlinear ambipolar diffusion theory including the effects of charge separation and ion acceleration, the effect of a uniform magnetic field on the plasma when the ion mean free path is approximately equal to or less than the tube radius, and the effect of a nonuniform magnetic field. The theory shows that the definition of the ion mobility should include the ionization frequency. Applications of the theory are made to ion lasers and to the design of more efficient and/or higher power argon lasers. Author

N69-19372# Gulf General Atomic, San Diego, Calif.
CONTROLLED THERMONUCLEAR RESEARCH PROGRAM Summary Progress Report, 1 Jul.–31 Dec. 1967
P. H. Miller, Jr. and T. Ohkawa 15 Feb. 1968 17 p
(Contract AT(04-3)-167)
(GA-8526) Avail: CFSTI

A brief report on the conversion of the octupole device to a quadrupole configuration is given. Abstracts for papers presented at the 1967 annual meeting of the American Physical Society, Division of Plasma Physics, are given. NSA

N69-19412# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
ARC PHENOMENA AND GASDYNAMIC EFFECTS DUE TO INTERACTION OF SHOCK WAVES WITH MAGNETIC FIELDS
H. Klingenberg Aug. 1968 45 p refs
(IPP-3/78) Avail: CFSTI

The arc phenomena occurring on interaction of shock-heated plasma with a magnetic field were studied in order to achieve an approximately uniform current distribution in a certain volume using a number of small electrodes. Plane gasdynamic effects such as reflected shocks and one-dimensional flow behind them can thus be produced for future work in comparing experimental results with theory. The current amplitude depends on the surface area and the number of electrodes. It is governed by the complex boundary conditions in the plasma-to-electrode transition, which consists of narrow current channels leading to arc spots. The properties observed agree with those of normal arcs. Filling an interaction volume with current as uniformly as possible seems to have been achieved. Image converter pictures show a rather homogeneous incandescence in the interaction region. The retarding force per unit area acting on the supersonic plasma flow is of the order of the total hydrodynamic pressure of the flow. Streak photographs show that the flow is slowed down, and reflected fronts are observed. At lower initial pressure, the reflected front is again reflected at the contact front. Author

N69-19464# Atomic Energy Commission, Washington, D. C.
INVESTIGATION OF ELECTROMAGNETIC TRAP
O. A. Lavrent'ev 1968 82 p Transl. into ENGLISH from Magn. Lovushki, Vypusk 3, Nauk. Dumka (Kiev), 1968 p 77–147 In RUSSIAN and ENGLISH
(AEC-tr-7002) Avail: CFSTI

A machine translation of a review of methods employing electromagnetic traps for confining hot plasma is presented. NSA

N69-19507 Florida Univ., Gainesville.
A SPECTROMETRIC INVESTIGATION OF AN ELECTRODELESS DISCHARGE
Kynric Martin Pell (Ph.D. Thesis) 1967 83 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-9550

This dissertation is concerned with the experimental determination of the electron temperature distribution in a nonequilibrium, low pressure, electrodeless discharge. In view of the lack of excitation function data for complex atoms, such as argon which was used in this study, an approximate semicorona model was used. The temperature dependence of excited state population densities for neutral atoms and singly ionized ions predicted by the approximate model was used to obtain a relationship between the intensity ratio of two emission lines and the temperature. Integrated intensity distribution data were inverted numerically to obtain the radial dependence of the intensity. Ratios of the intensity of an ion emission line and an atom emission line at 25 radial locations in the plasma were used to obtain the temperature distribution. Dissert. Abstr.

N69-19524# Stanford Univ., Calif. Inst. of Plasma Research.
STUDIES OF PLASMA OSCILLATIONS Status Report No. 32, 1 Feb.–31 Jul. 1968
Sep. 1968 45 p refs
(Contract AT(04-3)-326)
(SU-IPR-259) Avail: CFSTI

The research is primarily directed toward the investigation of plasma wave propagation and instabilities in discharges at pressures of the order of 1 mtorr. The main interest is in instabilities which are similar to those occurring in thermonuclear fusion study devices. Current activities include the following topics: (a) Low frequency ion-acoustic and drift waves on the positive column in a magnetic field. An rf perturbation theory based on a self-consistent solution for the steady state column has been derived. (b) Electron cyclotron echoes. (c) Beam/plasma interaction. (d) Wave/wave interactions. The basic equations of small signal plasma wave theory may now be considered to have been well verified experimentally, and higher order approximations can be attempted. The work in this direction concerns the nonlinear coupling of cyclotron harmonic waves. Author (NSA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N69-18501 Ohio State Univ., Columbus.
PROPERTIES OF THE LATTICE GAS AND RELATED MAGNETIC SYSTEMS
Samuel Lewis Wiley (Ph.D. Thesis) 1968 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-12887

An investigation was made of the behavior of the classical lattice gas and quantum lattice gas, along with the related Ising and Heisenberg models of magnetism. After a review of the properties of the one-dimensional Ising Chain and classical lattice gas, the zeros of the grand partition function of the gas are found explicitly for both attractive and repulsive interactions. The zero-temperature magnetization-magnetic field and pressure-volume curves are obtained for certain types (e.g., square, hexagonal, cubic and body-centered cubic) of two and three dimensional lattices. The one-dimensional Ising interaction is then extended to next-nearest neighbors, by means of a transfer matrix approach. Exact solutions are given for the infinite chain in the limit of vanishing nearest-neighbor interactions or vanishing magnetic field. The extension of this technqiue to higher-order neighbors and higher dimensions is discussed. Dissert. Abstr.

N69-18517 Wisconsin Univ., Madison.
CALORIMETRIC INVESTIGATION OF TYPE 2 SUPERCONDUCTORS
Paul Zoller (Ph.D. Thesis) 1968 67 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 68-10940

The specific heat at constant applied magnetic field as a function of temperature between 1.5°K and 4.2°K was measured for spherical samples of In-Pb alloys. These alloys were type II superconductors. The predictions of the Ginzburg–Landau–Abrikosov theory and its extension to lower temperatures were transformed into predictions about the behavior of the specific heat. The influence of a non-zero demagnetizing factor on the magnetization curve and on the thermodynamic properties of ellipsoidal superconductors are presented in some detail. The experimental results are used for a discussion on the effect of irreversibility on the determination of Maki's parameters K_1 and K_2 in magnetization and specific heat measurements. Evidence is presented to show that K_1 can be determined reliably from specific heat measurements even in the presence of severe irreversibility. Dissert. Abstr.

N69-18521 Delaware Univ., Newark.
A STUDY OF LOW ENERGY ARGON SPUTTERING OF SINGLE CRYSTAL SEMICONDUCTING COMPOUNDS
James Comas (Ph.D. Thesis) 1967 88 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-13152

An experimental study of low energy argon sputtering has been performed on several single crystal semiconducting compounds. Three experimental phases of the sputtering process were investigated: (1) sputtering yields, (2) mass spectrometric analysis of the sputtered particles, and (3) the angular distribution of the species sputtered. Sputtering yields from single crystals of CdS (1010), InSb (orientation unknown), SiC (0001), GaAs (110) and (111), PbTe (111), and GaP (111), under bombardment by ions with energies in the 100 to 800 eV range, were obtained using target weight loss techniques. Targets were suspended from a sensitive quartz spring in a bell jar vacuum system and bombarded by Ar^+ ions drawn from a magnetically confined argon arc discharge. The target weight loss was determined by noting the spring deflection with a cathetometer. The experimental values for a (110) oriented GaAs target are compared with the theoretical yield obtained from an expression proposed by Pease. Dissert. Abstr.

N69-18527 Oklahoma Univ., Norman.
SURFACE STATES AND THE GOLD-n-SILICON SURFACE BARRIER
Chandrakant P. Goradia (Ph.D. Thesis) 1968 143 p
Avail: Univ. Microfilms: HC $6.80/Microfilms $3.00 Order No. 68-13264

An attempt was made to obtain a better understanding of the behavior of gold-n-silicon surface barrier diodes. Low reverse current, high breakdown voltage Au-n-Si surface barrier diodes were fabricated by using certain combinations of etch quenchants and surface treatments, and different ambient conditions on the surface properties of silicon were studied by performing low frequency field effect measurements on filament samples of silicon. A new ambient cycle was evolved in order to obtain the conductance minimum in the field effect measurements. Differential capacitance measurements were made in order to correlate the rectification characteristics of the surface barrier diodes with their diffusion potentials. These measurements were not successful due to slow charge migration on the silicon surface. A model of slow charge migration and the results of its experimental confirmation are presented. Dissert. Abstr.

N69-18561 Minnesota Univ., Minneapolis.
SPIN HAMILTONIAN, EXCHANGE AND NUCLEAR RELAXATION IN CRYSTALLINE HE3
Chandra Mohan Varma (Ph.D. Thesis) 1968 112 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-12289

In this work, some nuclear magnetic properties of crystalline ^3He are considered from first principles. A spin Hamiltonian is deduced and its matrix elements calculated by cluster expansion methods. A Heisenberg form of the spin-Hamiltonian is found adequate, but the customary exchange integral replaced by an 'exchange operator,' which has matrix elements in phonon space. The diagonal elements of the 'exchange operator' are used to derive an expression for the exchange frequency, which depends on the density and the temperature, and includes the effect of long-range (phonon) and short-range (hard-core) correlations in the crystal. The density and temperature dependence of the exchange frequency is calculated, using an isotropic phonon spectrum and short-range correlation function obtained in a self-consistent fashion from a variational treatment. Dissert. Abstr.

N69-18565 New York Univ., N. Y.
ELECTRIC FIELD DEPENDENCE OF POSITRONIUM FORMATION IN MOLECULAR SUBSTANCES
Howard Feibus (Ph.D. Thesis) 1967 76 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-10055

Positronium (Ps) can be formed whenever positrons, on slowing down in a substance, pass through an Ore gap, i.e., a range of energies just below the ionization threshold of the substance of width comparable to the Ps binding energy. The time evolution of the energy distribution of the positrons below the ionization threshold in the presence of an external electrostatic field has been studied and it is found that (1) the field induces diffusion out of the Ore gap, which reduces Ps formation, (2) the overall heating effect of the field on the positrons increases Ps formation. Depending on the magnitude of the relevant cross sections, (1) can outweigh (2) at small fields and cause a significant decline in the Ps formation. At field strengths greater than a characteristic value, (2) becomes the dominant effect. In this way measurements of the field

dependence of Ps formation can give access, at the energies of the Ore gap, to the cross sections of Ps formation and of positron energy loss and scattering in matter. Dissert. Abstr.

N69-18570 State Univ. of Iowa, Iowa City.
THE MAGNETIC PROPERTIES OF SINGLE CRYSTALS OF ERBIUM AND SOME YTTRIUM-ERBIUM AND LUTETIUM-ERBIUM ALLOYS BETWEEN 1.2 AND 300°K
Walter James Gray (Ph.D. Thesis) 1968 132 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-10462

Carefully analyzed spherical single crystal samples were prepared of erbium and of alloys whose approximate compositions were: $Y_{25}Er_{75}$, $Y_{50}Er_{50}$, $Y_{75}Er_{25}$, $Lu_{25}Er_{75}$, $Lu_{50}Er_{50}$, and $Lu_{75}Er_{25}$. Magnetic measurements were made on each of these samples along the three principle crystallographic axes in the range 1.2 to 300°K and applied fields up to 27.9 K-Oe. For pure erbium, the saturation moment along the c-axis was found to be 276.0 ± 2.0 emu/g, by fitting the data to a T^2 plot and extrapolating to 0°K. None of the alloys studied were ferromagnetic in zero field. The Néel temperatures of the alloys were proportional to the 2/3 power of the average de Gennes factor, $T_N = AG^{2/3}$. The constant, A, was found to be 49.0 for the yttrium-erbium alloys and 53.5 for the lutetium-erbium alloys. An anomalous peak was observed in the c-axis moment vs. temperature curves for two alloys, $Lu_{25}Er_{75}$ and $Y_{50}Er_{50}$. In both alloys, the peak was not observed at fields less than about 5 K-Oe. From the paramagnetic data, the magnetic moments, in terms of the effective number of Bohr magnetons per erbium ion, were found to be within experimental error of 9.97 ± 0.1 for erbium as well as for all the alloys. Dissert. Abstr.

N69-18577 Clemson Coll., S. C.
ELECTRON IRRADIATION AND ISOCHRONAL ANNEALING OF SINGLE CRYSTALS OF ALUMINUM AT LOW TEMPERATURES
Randolph Earl Longshore (Ph.D. Thesis) 1968 99 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-13461

Aluminum foil was used to grow large grains by a strain-induced grain boundary migration technique. The grains were x-rayed to determine crystallographic orientation and large grains with the desired orientation were thinned and cut into individual samples with an acid saw. Samples were mounted on a holder and an additional chemical polishing reduced the thickness to approximately 3×10^{-3} cm. Single crystal samples and polycrystalline samples were kept below a temperature of ten degrees Kelvin during the irradiations with energetic electrons. Irradiations were performed at different electron energies which ranged from 0.18 to 0.40 MeV. After each irradiation, isochronal annealing was performed to resolve the I_B, I_C and I_{D+E} substages. Annealing data showed that the I_B substage was influenced by the irradiation energy and the orientation of the irradiation direction with respect to the crystallographic directions in a sample. The percent of I_B recovery for the single crystal sample that was irradiated in the ⟨100⟩ direction increased rapidly as the irradiation energy was decreased. Dissert. Abstr.

N69-18582 Washington Univ., Seattle.
THE MOSSBAUER EFFECT OF Fe 57 IN FERROUS FLUORIDE AND FERROUS CHLORIDE
Duane Peter Johnson (Ph.D. Thesis) 1967 149 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-9295

Mossbauer velocity spectrums of Fe^{57} in ferrous fluoride and ferrous chloride powdered absorbers have been investigated at several temperatures between room temperature and helium temperature. The quadrupole splitting, velocity shift, and Mossbauer fraction have been determined. A detailed discussion is given of the relationships between the Mossbauer fraction and the velocity spectrum, including the effects of various types of line broadening. The expected behavior of the Mossbauer fraction and thermal shift for harmonic interatomic forces is also discussed in detail. The Mossbauer fraction of ferrous chloride, unlike that of ferrous fluoride, shows an anomalously weak temperature dependence which cannot be explained by any harmonic model for the interatomic forces or by the usual high temperature anharmonicity. This anomalous behavior implies a low temperature anharmonicity which is qualitatively explained in terms of the relative sizes of the ions involved. The results of other Mossbauer f studies are consistent with these size arguments. Dissert. Abstr.

N69-18583 Princeton Univ., N. J.
AN INVESTIGATION OF THE BULK CONDUCTION PROPERTIES OF AMORPHOUS SELENIUM THIN FILMS
Edward L. Rossiter (Ph.D. Thesis) 1968 220 p
Avail: Univ. Microfilms: HC $9.90/Microfilm $3.00 Order No. 68-9692

Electron and hole mobilities were studied in amorphous selenium films using electron beam bombardment to generate hole-electron pairs just under a thin gold electrode. The measurements were made under two limiting conditions determined by the width of the excitation pulse, pulses long compared to the carrier transit time and pulses short compared to this time. The long pulse limit produces transient space charge limited currents for both holes and electrons (with the proper bias) which follow quite closely the time dependence predicted by theory with relatively mild trapping. However, an anomalous increase of mobility with increasing voltage was observed. The short pulse limit is a crystal counter experiment in which charge transport rather than current is measured. The anomalous mobility effect was also observed in these experiments. From both types of measurements room temperature mobilities for electrons and holes were found. In addition to transient measurements, steady state I-V characteristics with an electron bombardment were studied. Dissert. Abstr.

N69-18594 Louisiana State Univ., Baton Rouge.
A SYSTEMATIC STUDY AND APPLICATIONS OF THE EIGENVALUE FOR QUADRATIC HAMILTONIANS
James Lannis Roberts (Ph.D. Thesis) 1968 95 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-10757

The given study is oriented toward practical applications in the area of the many-body problem. The procedure accomplishes a canonical reduction of such a Hamiltonian to the form of the Hamiltonian for a collection of noninteracting bosons, with the eigenvalues of the Hamiltonian expressed in terms of the solutions to a single secular equation. Application of the results to systems of interacting identical bosons is discussed, including a presentation of a useful calculational technique for application to two specific problems. The first is an exactly solvable separable potential model of particle field theory, consisting of the description of a collection of light bosons interacting with an infinitely heavy boson via a simple separable potential. The second and more realistic problem is the polaron problem of solid state physics, involving the description of the motion of a single conduction electron within an ionic solid. It has value not only in solid state physics, but, like the first problem, is useful as a testing ground for approximation techniques. Dissert. Abstr.

N69-18599 Rochester Univ., N. Y.
POSITRON ANNIHILATION AS A PROBE FOR MANY BODY EFFECTS IN METALS
Ted Warren Mihalisin (Ph.D. Thesis) 1968 205 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 68-9387

The objective of the work was to explore the capabilities of the positron annihilation technique in the studies of the superconducting and ferromagnetic states. Earlier attempts to observe

the momentum smearing in soft superconductors utilized angular resolutions which were a factor of 10 to 100 times too large to observe the predicted effect. The intermetallic compound V_3Si was chosen for the superconductivity experiment because it has the smallest reported coherence length and consequently the largest momentum smearing. Due to the radical 3d fermi surface predicted for this material by Weger, room temperature measurements were performed on (111) and (100) single crystals. The isotropic results largely discredited this prediction and were consistent with a later calculation by Mattheiss. In positron annihilation studies on superconducting V_3Si no change (to ± 0.1%) in the coincidence rate was observed for three angles near the fermi angle. Earlier work demonstrated that spin polarized positron annihilation studies can give information concerning the momentum distribution of spin moments in a ferromagnetic metal. In the present work angular correlation studies were made on (111), (100) and (110) single crystals of nickel. Dissert. Abstr.

N69-18661 Purdue Univ., Lafayette, Ind.
A SPECTROSCOPIC INVESTIGATION OF ACCEPTOR STATES IN GERMANIUM
Rex Lawrence Jones (Ph.D. Thesis) 1968 145 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-12569

The zero stress spectra of the Group III acceptors in germanium were obtained. The results show that the p-like states for all five of these impurities are identical. The data also permit accurate estimates to be made of the relative chemical shifts of the ground states. These latter estimates indicate that the functional dependence of the binding energy of a Group III impurity is governed more by the ionic radius of the impurity than by the atomic number. In the case of the unstressed spectrum of neutral zinc impurity, more excitation lines have been observed than previously reported while, with regard to line spacings and relative intensities, the total excitation spectrum is practically identical to that of a Group III impurity. Correlation of the zero stress excitation spectra of Group III impurities in germanium with the results obtained theoretically, strongly suggests that the excitation line is due to a transition from a fourfold degenerate ground state to a twofold degenerate excited state. Dissert. Abstr.

N69-18675 Pennsylvania Univ., Philadelphia.
A MEASUREMENT OF e/h USING THE ac JOSEPHSON EFFECT
William Henry Parker (Ph.D. Thesis) 1967 166 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-9228

If two superconductors separated by a sufficiently thin insulating layer are maintained at a potential difference V, an ac supercurrent of frequency $\nu = 2eV/h$ will flow between them. This relation, known as the Josephson frequency-voltage relation, can be shown to be a direct consequence of some quite basic assumptions concerning the macroscopic quantum nature of the superconducting state, and is believed to be an exact relation. A measurement of this frequency and the voltage difference between the two superconductors has yielded a direct determination of the fundamental constant e/h. Measurements were performed on two types of "junctions" which show ac Josephson effect phenomena — evaporated thin film tunnel junctions, and point contact weak links. Two phenomena resulting from the ac Josephson effect were used to determine the frequency of the ac supercurrent: radiation emission from a tunnel junction voltage biased on one of the self-induced current steps, and excess currents which appear in the I-V curve of a Josephson junction when irradiated with microwave power. Dissert. Abstr.

N69-18713# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
LIQUID STATE BEHAVIOR OF SEMI-CONDUCTING DEVICES [COMPORTEMENT A L'ETAT LIQUIDE DES MATERIAUX SEMICONDUCTEURS]
Michel Vandevyver Sep. 1968 30 p refs In FRENCH; ENGLISH summary
(CEA-R-3552) Avail: CFSTI

This review of the liquid-state behavior of some solid state semi-conducting materials deals particularly with the 'short-distance order' which persists, with modifications, above melting point temperatures and is responsible for the semi-conducting properties of certain liquids. A decrease in the mobility of the carriers is generally observed on fusion, whereas the width of the forbidden zone increases: ΔEg_1 which is related to the expansion of the crystal is usually positive whereas ΔEg_2 which is related to a change in the short-distance order is negative. Their sum, either positive or negative, denotes an increase or a decrease in the semi-conducting nature of the material at its melting point. Various examples are presented, particularly, the selenium-tellurium solutions. The experimental study of the electrical properties of liquids can be difficult especially the Hall effect, but theoretical studies are now providing semi-quantitative hypotheses. Author (ESRO)

N69-18735 California Univ., Berkeley.
SUPERCONDUCTING PROPERTIES OF SEMICONDUCTORS
Calvin Scott Koonce (Ph.D. Thesis) 1967 200 p refs
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 68-10354

The theory of degenerate many valley semiconductors has been formulated in a general way to include polar intravalley interactions and screening of intervalley interactions. The kernels appearing in the superconducting gap equation have been discussed and the qualitative behavior of the kernels as a function of electron concentration determined analytically. The theory, using the exact kernels, is then applied to $SrTiO_3$, and the superconducting transition temperature is obtained as a function of carrier concentration with the help of a computer. The experimentally determined normal state properties of $SrTiO_3$ were used with the exception of the intervalley deformation potential which has not been determined experimentally. The value of the intervalley deformation potential is obtained by fitting the experimental superconducting transition temperature at one electron concentration. The complete curve of transition temperature as a function of electron concentration is then obtained and compared with the curve determined experimentally. The agreement is found to be good. Dissert. Abstr.

N69-18788# Centre d'Etudes et de Recherches en Technologie Spatiale, Toulouse (France).
TIME EQUIVALENCE PROBLEM BY IRRADIATION: ROLE OF IMPURITY GROUPS III AND V. [PROBLEME DE L'EQUIVALENCE EN TEMPS D'UNE IRRADIATION. ROLE DE L'IMPURETE DES GROUPES III ET V]
A. Roizes Sep. 1968 17 p refs In FRENCH
(CERTS-NT-02-10) Avail: CFSTI

The effects of an interstitial atom in a silicon crystal are discussed. Irradiation causes the displacement of substitutional impurity atoms in an interstitial position. Interstitial and substitutional impurities compete for blocking vacancies when their numbers are about equal and the former lead to a recombination of vacancies whilst the latter give rise to E-type defects. When the irradiation time is much longer than the time of recombination of the vacancies arising from interstitial impurities, the number of defects created is much less than those obtained by a short irradiation time with the same dose. Consequently, in spatial simulation studies not only the total dose but also the period of irradiation must be taken into account. ESRO

N69-18806# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

ELECTRICAL PROPERTIES OF MOLECULAR CRYSTALS [PROPRIETES ELECTRIQUES DES CRISTAUX MOLECULAIRES]

Andre Barraud Sep. 1968 22 p refs In FRENCH; ENGLISH summary

(CEA-R-3548) Avail: CFSTI

This literature survey summarizes the electrical properties of molecular crystals: molecular crystal structure, transport and excitation mechanisms of charge-carriers, and their differences compared to inorganic semi-conductors. The main results concerning the electrical conductivity of the most-studied molecular crystals are presented, together with their optical and photo-electrical properties. Finally the results of different types of electrical measurements as well as the limits are reviewed. Author (ESRO)

N69-18810# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

STUDY OF CURRENT INSTABILITIES IN HIGH RESISTIVITY GALLIUM ARSENIDE [ETUDE DES INSTABILITES DE COURANT DANS L'ARSENIURE DE GALLIUM DE HAUTE RESISTIVITE]

André Barraud (Ph.D. Thesis--Paris Univ., 17 Oct. 1967) 3 Apr. 1968 118 p refs In FRENCH; ENGLISH summary

(CEA-R-3533) Avail: CFSTI

A study is made of the current oscillations produced in high-resitivity gallium arsenide by a strong electric field. The oscillations are associated with the slow travelling of a region of high electrical field across the whole sample. An experimental study of the properties of these instabilities has made it possible for us to distinguish this phenomenon from the Gunn effect, from acousto-electric effects and from contact effects. In order to account for this type of instability, a differential trapping mechanism involving repulsive impurities is proposed; this mechanism can reduce the concentration of charge carriers in the conduction band at strong electrical fields and can lead to the production of a high-field domain. By developing this model qualitatively it has been possible to account for all the properties of high-resistance gallium arsenide crystals subjected to a strong electrical field: increase of the Hall constant, existence of a voltage threshold for these oscillations, production of domains, of high field, low rate of propagation of these domains, and finally the possibility of inverting the direction of the propagation of the domain without destroying the latter. A quantitative development of the model makes it possible to calculate the various characteristic parameters of these instabilities. Comparison with experiment shows that there is a good agreement, the small deviations coming especially from the lack of knowledge concerning transport properties in gallium arsenide subjected to high fields. From a study of this model, it appears that the instability phenomenon can occur over a wide range of repulsive centre concentrations, and also for a large range of resistivities. This is the reason why it appears systematically in gallium arsenide of medium and high resistivity. Author (ESRO)

N69-18841 Kansas State Univ., Manhattan.

CRYSTAL STRUCTURE INFORMATION FROM MEASUREMENTS OF X-RAY ANOMALOUS TRANSMISSION

Mark Jerome Dreiling (Ph.D. Thesis) 1968 133 p

Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 69-9907

A study was made of the dynamical theory of the diffraction of x-rays through crystals in an effort to define the properties of a measurable parameter, epsilon, which is structure dependent. The dynamical theory predicts an x-ray intensity field in the crystal which is fixed with respect to the unit cell for a given reflection at the Bragg angle. This fixes a frame of reference for the interaction of the unit cell atoms with the field. The relation of this interaction to the position of the atoms in the field was studied in an effort to obtain information on the crystal structure. It was found that, by measuring the value of epsilon for several wavelengths for the same reflection, point structure solutions could be obtained. Multiple solutions are obtained when there are more than one atom of a type in the unit cell. The proper solution is obtained by measuring additional reflections. Author

N69-18897*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

CHANGES IN MINORITY-CARRIER LIFETIME IN SILICON AND GALLIUM ARSENIDE RESULTING FROM IRRADIATION WITH 22- AND 40-MeV PROTONS

Marvin E. Beatty Washington Feb. 1969 26 p refs

(NASA-TN-D-5028) Avail: CFSTI CSCL 20L

Experiments were performed to examine the differences in the damage produced in n-type and p-type silicon and n-type gallium arsenide by irradiation with 22-MeV and 40-MeV protons. The parameter used to examine these differences was the minority-carrier lifetime in the base region of a photovoltaic p-n junction. From the data obtained, the relative merits of the three types of semiconductor material are compared in regard to their performance in a space radiation environment. Results of the experiments indicate gross differences in reduction of minority carrier lifetime between the three materials. Gallium arsenide was least affected by radiation; p-type silicon was next. Curves and tables are presented to depict some differences between the materials. It is concluded that gallium arsenide might be preferable to silicon in some devices to be subjected to a radiation environment. It was also found that 22-MeV protons produced a much higher degree of damage in silicon than 40-MeV protons did. The differences in damage produced were not so pronounced for gallium arsenide irradiated with protons of these two energies. Author

N69-18900 Illinois Univ., Urbana.

OPTICAL ABSORPTION ASSOCIATED WITH GRAIN BOUNDARIES IN N-TYPE GERMANIUM

Jerrold Lloyd McNatt (Ph.D. Thesis) 1968 110 p

Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-12167

The optical absorption by 4° to 25° grain boundaries in germanium bicrystals in the spectral region 0.40 eV to 0.80 eV was measured using two modulation techniques. The first technique measured directly the difference in optical absorption between the grain boundary layer and the adjacent single crystal regions. The second technique measured the changes in absorption produced when dc and ac electrical biases were applied across the grain boundary. Grain boundary absorption was found to be composed of two relatively distinct components. One, which varies in magnitude as the bias across the grain boundary is varied, is due to electric field-assisted absorption in the grain boundary space charge layer. The second component was independent of applied bias. The absorption occurs in the narrow deformed region at the grain boundary plane and is probably due to the combined effects of lattice disarray and broken covalent bonds in this region. Dissert. Abstr.

N69-18918 European Organization for Nuclear Research, Geneva (Switzerland).

REPORT ON WORK CONCERNING ELEMENTS OF HIGH ENERGY BEAM TRANSPORT WITH SUPERCONDUCTORS [RAPPORT SUR L'ETAT DES TRAVAUX CONCERNANT DES ELEMENTS DE TRANSPORT DE FAISCEAUX DE HAUTE ENERGIE AVEC SUPRACONDUCTEURS]

A. Cordaillat *In its* Util Studies for a 300GeV Proton Synchrotron, Vol. 2 30 May 1967 p 153-159 refs In FRENCH (See N69-18907 08-11)

(CERN/ECFA-66/WG2/US-SG1/AC-1) Avail: CFSTI

A list of various research projects carried out at CERN on beams, magnets, and quadropoles is summarized. The names of research firms taking active part in the fabrication of superconductors is also included.
Transl. by B.P.

N69-18919 Commissariat a l'Energie Atomique, Saclay (France). Dept. de Physique des Particules Elementaires.
GENERAL ASPECTS OF THE TECHNOLOGY AND OF THE USE OF SUPERCONDUCTING BEAM MAGNETS [ASPECTS GENERAUX DE LA TECHNOLOGIE ET DE L'EXPLOITATION DES AIMANTS DE FAISCEAUX SUPRACONDUCTEURS]
H. Desportes *In* CERN Util. Studies for a 300 GeV Proton Synchrotron, Vol. 2 30 May 1967 p 162–197 In FRENCH (See N69-18907 08-11)
Avail: CFSTI

The principal technological problems associated with using superconducting magnets in high energy beam accelerators were discussed: material availability and price, superconductivity and stability, and refrigeration. Three materials are currently available for use: Nb-Zr, Nb-Ti, and Nb-Sn. Their applications are connected to their critical fields; e.g., Nb-Zr can be used effectively up to 40 kGs; Nb-Ti to 80 kGs; and Nb-Sn to 150 kGs. The field current performances of these materials are graphed along with a comparison of their respective prices. Factors which affect the reliability and stability of the superconducting windings in the magnet core are briefly reviewed. A more detailed discussion is presented on the problems and costs associated with refrigeration requirements for superconducting magnets.
Transl. by B.P.

N69-18920 European Organization for Nuclear Research, Geneva (Switzerland).
PRELIMINARY STUDY OF SUPER CONDUCTING COIL MAGNETS AND QUADRUPOLES [ETUDE PRELIMINAIRED D'AIMANTS ET QUADRUPOLES A BOBINES SUPRACONDUCTRICES]
J. P. Pouillang *In its* Util. Studies for a 300 GeV Proton Synchrotron vol. 2 30 May 1967 p 199–201 refs In FRENCH (See N69-18907 08-11)
(CERN/ECFA/66WG2/US/SG1/JPP1) Avail: CFSTI

Two iron components and two components with coils functioning in air were investigated. In the iron studies, it was necessary to replace the conventional coils by superconducting coils. The quantity of the superconductor required was very moderate. The essential characteristics of the components functioning in air are outlined. The absence of a magnetic circuit reduces the problem of recovery of electromagnetic forces and simplifies the topology of the cryostat.
Transl. by P.A.B.

N69-18921 European Organization for Nuclear Research, Geneva (Switzerland).
PRELIMINARY STUDY OF SUPERCONDUCTING COILS OF DIPOLES AND QUADRUPOLES FUNCTIONING IN AIR [ETUDES PRELIMINAIRES DE DIPOLES ET QUADRUPOLES A BOBINES SUPRACONDUCTRICES FONCTIONNANT DANS L'AIR]
J. P. Pouillang and G. Bronca *In its* Util. Studies for a 300 GeV Proton Synchrotron, Vol. 2 30 May 1967 p 203–234 refs In FRENCH (See N69-18907 08-11)
(CERN/ECFA/67-WG2/US/SGI/JPP2) Avail: CFSTI

Coil models for the creation of the dipolar and quadrupolar fields are defined and algorithms indicated. The application of superconductors to operational coil windings is treated; an attempt to find optimal superconductor stability is begun. Specific dipole and quadrupole cases are then numerically treated.
Transl. by P.A.B.

N69-18922 European Organization for Nuclear Research, Geneva (Switzerland).
PRELIMINARY STUDY OF SUPRACONDUCTING BEAMS [ETUDE PRELIMINAIRE DE FAISCEAUX SUPRACONDUCTEURS]
G. Bronca (CNEA, Saclay, France), A. Cordaillat, H. Desportes (CNEA, Saclay, France), and J. P. Pouillange (CNEA, Saclay, France) *In its* Util. Studies for a 300 GeV Proton Synchrotron, Vol. 2 30 May 1967 p 235–253 refs In FRENCH (See N69-18907 08-11)
(CERN/ECFA/67/WG2/US/SG1/BCDP) Avail: CFSTI

A summary review is presented of conventional and superconducting elements of 30, 50, 100, and 150 GeV/c beams to be used in the 300 GeV/c proton synchrotron. The economic aspects of the beams are tabulated considering materials cost, current densities, refrigeration requirements, and fabrication.
Transl. by B.P.

N69-18943 California Univ., Riverside.
THE OPTICAL POTENTIAL FOR ELECTRONS IN SOLIDS
Raymond Kwong-Man Chow (Ph.D. Thesis) 1967 98 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-8752

Two-particle states are constructed from symmetrized bilinear combinations of Bloch states. Use is made of these states to evaluate the matrix elements of the t-matrix for a pair of particles interacting through a short-range potential in a crystal. Expressions for the t-matrix are derived for (1) interaction at the same lattice sites, (2) many-band interaction and (3) interaction extending to nearest neighbors. It is shown that in each case, the t-matrix can be reduced to the same form with the definition(s) of effective potential(s). The optical potential for an ideal solid with spherical Fermi surface and a spherical Brillouin zone is obtained for energies below and above the Fermi surface. The optical potential for energies below E_F is nearly constant for a wide range of densities and strengths of interaction. This behavior is also exhibited by the real part of the optical potential for energies greater than E_F provided that particles far removed from the Fermi surface are excluded from consideration.
Dissert. Abstr.

N69-18961# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab
A REVIEW OF LARGE POLARONS IN THE LOW TEMPERATURE LIMIT AND OF SMALL POLARONS IN THE HIGH TEMPERATURE LIMIT
Richard A. Sevenich Oct. 1968 59 p refs
(Contract AT(45-1)-1830)
(BNWL-903) Avail: CFSTI

A comprehensive review is given of the theory of large polarons in the low-temperature limit and of small polarons in the high-temperature limit. Where possible, reference is made to the applicability of small polaron theory to electrical conduction in some metal oxide insulators. The purpose of the report is to give the theoretical foundations and approximation inherent in small polaron theory in order to facilitate applications of the theory toward explaining electrical conduction in some metal oxide insulators.
Author (NSA)

N69-19086*# Rice Univ., Houston, Tex.
RESEARCH ON THE PHYSICS OF SOLID MATERIALS Semiannual Status Report, 1 Nov. 1967–30 Jun. 1968
30 Jun. 1968 48 p refs
(Grant NsG-6-59)
(NASA-CR-100148; SASR-18) Avail: CSCL 20L

Research reports are presented on physical properties of solids. Defect structure, plastic deformation, and the relation of mechanical properties to the behavior of dislocations are discussed. Investigations on the electrical, microwave, optical, and gamma ray optical properties of solids are summarized. Spin-lattice interactions in rare earth metals, and the dynamics of flux penetration and flux

motion in Type I and Type II superconductors were studied. Thermodynamic and kentic studies, both theoretical and experimental on solid surfaces and bulk solids are described. Investigations of vacuum-evaporated magnetic thin films centered on characterizing their structure and relating it to their magnetic properties, and on flux reversal behavior. N.E.N.

N69-19059*# Illinois Univ., Urbana. Coordinated Science Lab.
AN EXPERIMENTAL INVESTIGATION OF RADIATION EFFECTS IN SEMICONDUCTORS Final Report, Jan. 1962–Sep. 1968
W. Dale Compton Sep. 1968 16 p refs
(Grant NsG-228-62)
(NASA-CR-98835) Avail: CFSTI CSCL 20L

A summary of research on the effects of high energy radiation upon the properties of silicon is presented. The studies concentrated upon the measurements of the properties of silicon with emphasis upon the development of new techniques and methods of studying radiation induced defects. All measurements were made upon single crystals. Publications of the important results of this work are listed along with their abstracts. These publications report detailed measurements of the changes in minority carrier lifetimes of silicon with irradiation, of the luminescence arising from electron-hole recombination at defects introduced into silicon by irradiation, of the changes that occur in the conduction of heavily doped germanium with neutron irradiation, and of the study of the tunneling into highly doped semiconductors. The luminescence has been shown to be a very powerful tool for examining the properties of defects whose energy levels are deep in the forbidden band. Author

N69-19084# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Metallurgie.
STACKING FAULT IN ALUMINUM–SILVER MIXED CRYSTALS [STAPELFEHLER IN ALUMINIUM–SILBER-MISCHKRISTALLEN]
E. M. Hoerl 1968 11 p ref In GERMAN Submitted for publication
(SGAE-M-21/1968) Avail: CFSTI

Electron microscopic analyses on silver-aluminum crystals showed that stacking faults were caused by the formation of Ag_2Al and also by hole fromations in [111] lattice surfaces. Twinning was seldom observed. Transl. by G.G.

N69-19120 Virginia Polytechnic Inst., Blacksburg.
PROTON SPUTTERING OF POLYCRYSTALLINE GOLD
Charles Ryno Finfgeld (Ph.D. Thesis) 1968 66 p
Avail: Univ. Microfilms; HC $3.80/Microfilm $3.00 Order No. 68-8992

An experiment to determine the yield and angular distribution for sputtering of polycrystalline gold by normally incident protons of energies between 500 eV and 8 keV has been performed. An ion source system delivering a magnetically analyzed proton beam of 1 ma/cm^2 current density to a target at a pressure of 5×10^{-8} torr was utilized. Measurement of the integrated proton current, with correction for secondary electron emission, and determination of the quantities of sputtered gold by neutron activation, established the yields. Autoradiographs of the sputtered deposits were used to study the angular distribution. The gold targets, consisting of micro-crystals with preferred orientation, were sputtered predominantly on (100) and (110) planes, and the yields were not observed to depend perceptibly on the crystal orientation. Analysis of the sputtered deposit spot patterns indicated that focused collision sequences were of greater importance in proton sputtering than in sputtering by heavier ions. Significantly, a readily detectable yield for sputtering by 500 eV protons, which could transfer at most 10 eV to gold atoms in the target, suggests a new, lower sputtering threshold for gold. Dissert. Abstr.

N69-19141# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
EXPERIMENTAL STUDIES OF LONG JOSEPHSON JUNCTIONS
A. M. Goldman Mar. 1968 7 p refs Presented at Conf. on Fluctuations in Superconductors, Pacific Grove, Calif., 1968
(Contract AT(11-1)-1569)
(COO-1569-27) Avail: CFSTI

The I–V characteristic of a strongly coupled, current-biased $Sn/Sn_xO_y/Sn$ junction at 1.3°K in a magnetic field H ≈ 11 G shows an infinite slope segment at V ≈ 1.5 mV. The continuous variation with applied magnetic field of the voltage at which this anomaly occurs suggests that it is not a self-induced step. The dependence of the normalized ratio V/H for the infinite slope anomaly on magnetic field follows the function $\sqrt{1-(H_c/H)^2}$, where H_c is the smallest field at which the anomaly may be seen, indicating that the anomaly is associated with the mixed state–Meissner state transition at finite voltages. NSA

N69-19184# Argonne National Lab., Ill. Chemistry Div.
CRYSTAL STRUCTURES OF CUBIC AND TRIGONAL YTTRIUM HYPOCARBIDES: A DIMORPHICALLY INTERPHASED SINGLE-CRYSTAL STUDY
M. Atoji and M. Kikuchi May 1968 68 p refs
(Contract W-31-109-ENG-38)
(ANL-7441) Avail: CFSTI

The single-crystal structure determination is presented for yttrium hypocarbide, which exhibits two modifications: the high-temperature-disordered cubic structure having the composition YC_x ($x \cong 0.25 - 0.65$), and the low-temperature-ordered trigonal structure with the Y_2C stoichiometry. Both x-ray single-crystal and neutron powder techniques were employed in the structure determination. The quenched single crystal used has stabilized the transient state in the midst of the cubic-to-trigonal transition, and consists of one cubic and four trigonal crystals with the trigonal triad axis parallel to one of four cubic triad axes. The domain sizes of these five crystals are different from one another, resulting in highly complex diffraction patterns for which exceedingly elaborate dimensional and intensity interpretations have been carried out. The chemical compositions of the sample crystal were determined accurately by means of the diffraction-intensity analysis. Several new statistical and analytical methods have been derived and incorporated in the study. NSA

N69-19190# Martin Co., Baltimore, Md. Research Inst. for Advanced Studies.
RADIATION DAMAGE OF ORDERED VANADIUM PENTACARBIDE BY ELECTRON MICROSCOPE BEAM BOMBARDMENT
John D. Venables and R. G. Lye Oct. 1968 39 p refs Submitted for publication
(Contract NASw-1290)
(NASA-CR-100257; TR-68-15c; TR-8) Avail: CFSTI CSCL 20B

The superlattice and domain structures exhibited by the ordered compound V_6C_5 are disrupted by electron microscope beam bombardment. The effect is attributed to the disordering of the carbon sublattice that results from displacement of the carbon atoms by the impinging electrons. Studies have been made of the disordering rate under electron bombardment at energies from 33 keV to 100 keV, using a Faraday cup to measure superlattice spot intensities. The results are compared with the predictions of a simple theory for the damage process, from which it is concluded that the displacement energy of carbon atoms in V_6C_5 has the surprisingly low value of 5.4 eV. Author

N69-19262 Pennsylvania State Univ., University Park.
CRYSTAL GROWTH IN GELS
James Carl Dennis (Ph.D. Thesis) 1967 98 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-8680

A method is described which permits certain types of single crystals to be grown in silica gels. The technique is of special value for substances which by virtue of their low solubilities of low dissociation temperatures cannot readily be grown in other ways. It can yield large crystals (e.g., up to 11 mm) of high optical quality, doped or undoped. Most of the results refer explicitly to the insoluble iodides and tartrates, but a great variety of other crystals have been prepared. The nucleation rate and the uptake of impurities from the gel are found to be functions of the irradiation intensity and dosage. Existing theories are tested which apply specifically to crystal growth in stagnant solutions by means of gel systems. This thesis discusses some of the principle factors on which nucleation in gels depends and shows how nucleation can be controlled by concentration programming, by trace impurities, and by varying the gel structure. Dissert. Abstr.

N69-19264 Rochester Univ., N. Y.
SUPERCONDUCTIVITY IN THE PRESENCE OF MAGNETIC EXCHANGE FIELDS
Jack Emerson Crow (Ph.D. Thesis) 1968 166 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-9366

The purpose of this study was to determine the effects of magnetic exchange fields on superconductivity by measuring various properties of systems with dilute concentrations of magnetic impurities. The system chosen for the detailed studies was $InLa_{(3-x)}R_x$ (where R=Ce, Nd, Gd or Dy). The dependence of T_c on the concentration of magnetic impurities for small concentrations is similar to that observed by other investigators and is consistent with the predictions of the Abrikosov–Gorkov theory. Measurements of the upper critical field as a function of temperature and spin impurity concentrations reveal two distinct regimes of particular interest. In the first, the conduction electrons see an internal exchange field produced by the alignment of the impurity spins in an external field. In the second regime, which is realized for higher impurity concentrations, the impurity spins are self-aligned as a consequence of spin–spin interactions. Dissert. Abstr.

N69-19317# California Univ., Berkeley. Lawrence Radiation Lab.
THE SUPERCONDUCTING CRITICAL CURRENT AND CRITICAL FIELDS OF Nb-3 Sn-NbC AND Nb-3 Sn-Nb COMPOSITES
Russell Howard Jones (M.S. Thesis) Sep. 1968 57 p refs
(UCRL-18437) Avail: CFSTI

The critical currents and critical fields of a Type-II superconductor are dependent on certain microstructural aspects. These properties have been studied using composite samples with Nb_3Sn surrounding grains of NbC and niobium. Two types of processing treatments have been examined resulting in desirable composite microstructures with good critical current and field values. Films of Nb_3Sn surrounding NbC grains were obtained by hot pressing powders of niobium, tin, and graphite. Films of Nb_3Sn surrounding niobium grains were obtained with presintered porous niobium impregnated with tin. Metallography, X-ray diffraction, and an electron-beam microprobe were used in the examination of the samples. The critical temperatures were measured and the field properties were determined using the pulsed field technique. The highest critical current obtained was 53,700 A/cm^2. The highest critical temperature was 17.8°K, and the best upper critical field was 234 kG. Author (NSA)

N69-19351# Rensselaer Polytechnic Inst., Troy, N. Y.
STUDY OF THE EFFECT OF HYDROSTATIC PRESSURE ON SELF-DIFFUSION RATES IN HEXAGONAL METALS Progress Report
H. Michael Gilder Oct. 1968 7 p ref
(Contract AT(30-1)-3820)
(RPI-3820-2) Avail: CFSTI

Crystallographically oriented a- and c-axes single crystals of zinc and cadmium were prepared, and diffusion coefficients for ^{110}Ag and ^{65}Zn in zinc were measured at atmospheric pressures in an investigation of the principal-axis activation volumes of cadmium and zinc. Single crystals were plated with ^{110}Ag and ^{65}Zn and the effect of pressure on the simultaneous diffusion of ^{110}Ag and ^{65}Zn in zinc in a direction 25° from the a-axis was measured at 368.7°C. NSA

N69-19367# Delaware Univ., Newark. Dept. of Physics.
RADIATION INDUCED DEFECTS IN ALKALI HALIDES, AND THEIR ROLE IN RECOMBINATION PROCESSES Annual Progress Report, 1 Mar. 1968–28 Feb. 1969
R. B. Murray 22 Nov. 1968 6 p
(Contract AT(30-1)-3842)
(NYO-3842-5) Avail: CFSTI

Progress of research in the following areas is reported: (1) radioinduced V_k centers of alkali metal halides; (2) radioinduced anion vacancies in thallium-doped potassium bromides; (3) V_k center diffusion in rubidium iodides; (4) activation energy for radioinduced centers in thallium-doped sodium chlorides; (5) effects of X radiation on V_k centers in alkali metal halide crystals. NSA

N69-19446 Rensselaer Polytechnic Inst., Troy, N. Y.
PHOTOCONDUCTIVITY INCLUDING STRESS-INDUCED DICHROISM OF DEFECTS IN SILICON
Arne Haerter Kalma (Ph.D. Thesis) 1968 147 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-13519

A new technique of using stress-induced reorientation of defect configurations in crystals and subsequent measurement of the photoconductivity spectra with polarized light is developed. This technique is applied to study defects in electron-irradiated, n-type silicon and it is shown that a measurable dichroism can result from a "normal" photoconductivity transition where the initial state is a defect state and the final state is a carrier band. Experimental results concerning the properties of the divacancy are compared with theoretical calculations of the divacancy defect states made using both energy band and linear combination of atomic orbitals treatments. Dissert. Abstr.

N69-19473 Princeton Univ., N. J.
ISOELECTRONIC IMPURITIES IN SEMICONDUCTORS
Roger Atwood Faulkner (Ph.D. Thesis) 1968 105 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-9676

Isoelectronic impurities in certain wide band gap semiconductors are observed to have a profound effect on the optical properties of the materials for photon energies in the vicinity of the band gap. In particular, the impurity systems: GaP:N, GaP:Bi, and ZnTe:O exhibit sharp absorption peaks within the forbidden gap which can be attributed to exciton bound states due to the impurities. A simple model is used to calculate the oscillator strength of the absorption line due to the bound state and the absorption coefficient for frequencies above the band edge. The strong optical absorption above the band gap in GaP:N is directly linked to the existence of the shallow bound state, and is a resonance phenomenon analogous to low energy neutron-proton scattering and the existence of the weakly bound deuteron. In GaP:N, many absorption lines are observed which can be attributed to bound states of an exciton to two Nitrogen impurities at various

interatomic spacings. The theoretical analysis of these states shows striking wave function interference effects due to the many-valley structure of the GaP conduction bands. Dissert. Abstr.

N69-19484 Vanderbilt Univ., Nashville, Tenn.
CRITICAL CURRENTS AND RESISTIVE STATES IN A TYPE-2 SUPERCONDUCTER (0.5 Nb 0.5 Ta)
William Edward Case (Ph.D. Thesis) 1967 80 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-5384

Critical current data and resistive state measurements are presented for cold-rolled and annealed sheet samples of $Nb_{0.5}Ta_{0.5}$. The Nb-Ta alloy was prepared as a single crystal of high purity prior to cold-rolling. The current density J was applied parallel to the rolling direction, and the effects of orientation of an external magnetic field (H_e) relative to J and the defect structures were studied. Microphotographs indicate that a planar fiber structure parallel to the rolling plane (RP) is introduced by cold-rolling. Critical currents are lower when planar fibers are oriented parallel to the direction of flux penetration. Dissert. Abstr.

N69-19486#
ELECTRONIC PHENOMENA ON SEMICONDUCTOR SURFACES. CHAPTER 1: THEORETICAL FOUNDATION OF THE EXISTENCE OF ELECTRONIC SURFACE STATES
V. I. Lisshenko 1968 16 p refs Transl. into ENGLISH from the book "Electronic Phenomena on Semiconductor Surfaces" Kiev, Naukova Dumka Press, 1968
Avail: CFSTI

An introductory chapter to a survey of the state of the art of research on semiconductor surface physics is presented. Question of semiconductor surface theory, methods of preparing real and atomically pure surfaces, methods and results of investigating electrical surface characteristics, nonequilibrium processes on the surface and in the layer near the surface (recombination, capture, and trapping of current carriers) are examined. The influence of the electrical state of a semiconductor surface on the adsorption and catalysis phenomena, as well as the characteristics of a metal-semiconductor contact, are expounded. The book is intended for scientific and engineering-technical workers involved with the physics, physical chemistry, and technology of semiconductors and semiconductor devices, as well as for students of physics faculties. Author

N69-19521# Battelle-Northwest, Richland, Wash.
LISTING OF A COMPUTER PROGRAM TO DETERMINE PARTICLE SIZE DISTRIBUTIONS
K. R. Merckx [1968] 9 p ref
(BNWL-CC-461) Avail: Issuing Activity

A general method was previously developed (W.L. Nicholson and K. R. Merckx, "Estimation of Spherical Particle Size Distributions") for determining the three-dimensional distribution of spherical particles or voids imbedded in a matrix from the distribution of circle diameters observed on a section of the matrix. The method estimates the variance as well as the distribution itself. The present paper is a listing of the FORTRAN IV program for a Univac 1107 which performs the calculations described in the original report. Although the program contains many comment cards as aids for understanding the numerical calculations, this report is only a supplement to the descriptive report. In converting programs between the Univac and IBM systems it was found that these two systems are not completely compatible even when programs are written in the same language. Some of the statements in this listing which may need special treatment in other systems are: "SETIO", which are statements renaming the input and output units; "DATA" statements which may have to be changed in other systems; and some "DO" loops which have negative increments. K.W.

N69-19566# Joint Publications Research Service, Washington, D. C.
ELECTRO-OPTICAL METHOD FOR PROVING THE SURFACE NATURE OF THE RIGID ELECTRIC DIPOLE OF ARBITRARY COLLIODAL PARTICLES OF WATER
N. A. Tolstoy et al 22 Jan. 1969 7 p refs Transl. into ENGLISH from Opt. i Spektroskopiya (Moscow), v. 21, no. 6, Dec. 1966 p 771–773
(JPRS-47280) Avail: CFSTI

Electro-optical determination of the size and structure of the rigid electric dipole moment of bacterium in water is analyzed by representing the bacterium as a model of colloidal particles. A number of colloidal solutions of various nature are evaluated as to their geometric particle characteristics by measuring the relaxation time of their orientation after the removal of the electrostatic field. Results confirm the surface nature of the rigid dipole of water particles; dipole moments per unit of area are the same for particles of different nature in various colloids. G.G.

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N69-18865*# Rocketdyne, Canoga Park, Calif.
SPACE STORABLE REGENERATIVE COOLING INVESTIGATION Interim Report, Jul.–Dec. 1967
R. P. Pauckert 25 Sep. 1968 222 p refs
(Contract NAS3-11191)
(NASA-CR-72360; R7338) Avail: CFSTI CSCL 21I

Analyses were conducted to determine the regenerative cooling capabilities of light hydrocarbon fuels when used with FLOX and OF_2 oxidizers over a wide range of operating conditions. Limits based on propellant decomposition, pressure drop, and coolant passage dimensions were applied. The presence or absence of a gas-side carbon layer was found to be significant. All of the hydrocarbons were suitable coolants with the carbon layer. Without the carbon layer only methane was applicable for regenerative cooling under all conditions; the other hydrocarbons were generally limited to low chamber pressures or high thrust levels. Author

N69-19000*# Aerojet-General Corp., Sacramento, Calif.
SYSTEM ANALYSIS OF GELLED SPACE-STORABLE PROPELLANTS Summary Report, May 1967–Apr. 1968
Jul. 1968 175 p refs
(Contract NAS7-473)
(NASA-CR-100186; Rept-1038-025) Avail: CFSTI CSCL 21I

A rapid condensation method for the preparation of fine particles of chlorine trifluoride was developed. These fine particles were used to gel liquid nitrogen and liquid oxygen difluoride. Ten pounds of liquid oxygen difluoride gelled with solid chlorine trifluoride was prepared. The structure index and flow properties of these gels were measured. These gels exhibited extensive shear thinning with increasing shear rate. Within the limits of the tests performed, the OF_2/ClF_3 gels appear to be chemically and mechanically stable. It was found that liquid nitrogen gelled with solid chlorine trifluoride possesses static and dynamic flow properties which closely approximate those of the OF_2/ClF_3 gels. Thus, N_2/ClF_3 gels may be used as suitable simulants for OF_2ClF_3 gels. Author

N69-19026*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DYNAMIC RESPONSE OF HYDRAZINE-NITROGEN TETROXIDE COMBUSTION TO TRANSVERSE GAS FLOW
Marshall C. Burrows Washington Feb. 1969 25 p refs
(NASA-TN-D-4984) Avail: CFSTI CSCL 21B

Combustion stability of a hypergolic system was studied for several variations of triplet element design. Tangential nitrogen flow induced the traveling transverse mode of instability within the chamber. Two types of unstable combustion were initiated by the nitrogen flow. In one type, the amplitude of the transverse wave was coupled to the tangential flow of nitrogen in that the oscillatory amplitude was proportional to the nitrogen flow. The second type of unstable combustion was induced by the nitrogen flow but continued with undiminished amplitude when nitrogen flow decreased making it a self-coupled response. The self-coupled response could be eliminated when center jet stability was increased sufficiently by increasing center jet velocity, diameter, or extending tube length downstream from the injector face. Observed jet breakup was correlated with an atomization model based on the progressive spreading of the liquid jets prior to impingement. The effect of transverse gas flow on jet breakup is evaluated. The breakup of jets prior to impingement can produce nonaxial flow sufficient to initiate combustion instability in a combustor. Sustained oscillations can also be driven by in-phase fuel decomposition and interfacial reactions. Proper shielding, alinement, and impingement of the jets within each injector element will minimize the generation of nonaxial flows which are conducive to unstable combustion.
Author

N69-19154# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
SLUSH HYDROGEN FLUID CHARACTERIZATION AND INSTRUMENTATION
C. F. Sindt, P. R. Ludtke, and D. E. Daney Feb. 1969 71 p refs
(NBS-TN-377) Avail: SOD $0.65

Areas of the slush hydrogen fluid characterization program covered are production, transfer, and storage of liquid-solid mixtures. An experiment was performed with a second component added to liquid hydrogen to determine the effect on the size of the solid particles produced by the freeze-thaw method. An experiment performed with 4.4% oxygen in nitrogen resulted in particles of smaller size than those observed in freeze-thaw production of pure nitrogen slush. The angle at which solids slide from the surface of several metals was found to be a function of the surface finish. A review of the pumping characteristics of slush hydrogen is presented. A comparison of developed head, efficiency, cavitation constant, and net positive suction head is discussed. Gelling of slush hydrogen with pyrogenic silica was accomplished with solid fractions from 0 to 0.2. The amount of gelling agent required to gel slush was found to be proportional to the liquid volume of the slush.
Author

N69-19432*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROPULSION DIVISION
In its Space Programs Sum. No. 37-54, Vol. 3, Oct./Nov. 1968 31 Dec. 1968 p 91-132 refs (See N69-19427 08-34)
Avail: CFSTI CSCL 21I

Results of continuing research in propellant engineering are reported. The interior ballistic design and experimental development of a self-obturating, propellant actuated device for use in planetary landing systems is described. Polymer research included development of a mathematical model for determining the effect of dewetting on the mechanical behavior of composites which form parabola shaped void cavities; investigation of the chemical and physical properties of sterilizable polymer battery separators; determination of creep properties of aging elastomer binders; and studies of stress relaxation in SBR-glass bead composites undergoing heat sterilization. In the area of advanced solid propellant research, results of further heat transfer experiments using an applied, transverse magnetic field in a square channel are summarized in the case of subsonic and initially supersonic gas flow. The thermionic diode kinetics experiment, part of the program for developing liquid metal cooled thermionic reactors for space powerplant application, is described. Finally, investigations of liquid metal MHD power conversion using liquid lithium, as well as liquid propulsion studies related to the combustion effects in sprays, are described.
A.C.R.

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N69-18753*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.
A METHOD FOR CALCULATING STEADY-STATE THRUST AND FLOW-RATE LEVELS FOR MARINER 4 TYPE ATTITUDE CONTROL NITROGEN GAS JETS
John D. Ferrara and Philip M. McKown 1 Dec. 1968 97 p refs
(Contract NAS7-100)
(NASA-CR-100070; JPL-TR-32-1353) Avail: CFSTI CSCL 21H

Steady state thrust and flow-rate determinations versus varying design parameters for the Mariner IV type ball valve-nozzle configurations are investigated, where a subsonic orifice is in series with a sonic nozzle throat separated by a chamber volume of approximately 0.2 cc. Design variables investigated included inlet pressure of 10 to 35 psi, ambient pressure of 1×10^{-6} torr, inlet temperature of -100 to $+150$°C, valve orifice area of 5×10^{-4} to 40×10^{-4} in.^{2}, nozzle throat diameter of 5×10^{-3} to 50×10^{-3} in., nozzle geometric area ratio of 25 to 275, and nozzle cone half-angle of 15 to 40 deg. Thrust levels considered are in the millipound range using cold nitrogen gas as the propellant. The equations used to determine nozzle losses were based on flat-plate analogies. The mathematical formulation and IBM 1620 computer program used in this analysis are also described.
Author

N69-18780# Weapons Research Establishment, Salisbury (Australia).
EUROPA 1, PHASE 3: ACCEPTANCE TESTING OF GN SUPPLIES AT THE UPPER STAGES LIQUID FUEL STORES, EDS AREA, WOOMERA
S. H. Sim Aug. 1968 11 p refs
(WRE-TN-DWD-19) Avail: CFSTI

The test results are presented. Deviations found are shown to be either unimportant or easily fixed, should the need arise.
Author (ESRO)

N69-18017*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL PERFORMANCE OF A WATER-ELECTROLYSIS ROCKET
R. James Rollbuhler Washington Feb. 1969 28 p refs
(NASA-TM-X-1737) Avail: CFSTI CSCL 21H

An experimental investigation was conducted to evaluate the performance characteristics of nominal 1-pound- (4.4-N-) thrust

water-electrolysis rocket engine system. The system was tested over a range of propellant flow rates and for various run durations in a vacuum pressure environment. The test results indicated a system specific impulse of 338 ± 17 seconds obtainable at a combustion-chamber pressure of 15 psia. Combustion efficiency was greater than 90 percent of theoretical, and combustion instability was not detected in any of the tests. Author

N69-19051*# Westinghouse Electric Corp., Dayton, Ohio. Astronuclear Lab.
THE TRANSPORT OF ATOMIZED DROPS IN WET VAPOR TURBINES
Thomas C. Varljen 5 Aug. 1968 97 p refs Supersedes WANL-TME-1711; see N68-25418
(Contract NAS7-390)
(NASA-CR-94708; WANL-TME-1836; WANL-TME-1711) Avail: CFSTI CSCL 21B

A model describing the transport of atomized condensate in wet vapor turbines was assembled. The basic problem which is considered is the trajectories of drops of liquid in the space between the rotor, where it is discharged, and the rotor inlet plane. Relatively simple closed form solutions for the drop equation of motion were obtained for certain special cases. A detailed calculational procedure was developed to provide specific solutions to the problem in a more general context. The drop transport code package was described in detail. The scope of the numerical treatment is as follows: (1) estimation of stator blade boundary layer characteristics; (2) generation of the local velocity field within the vapor wake downstream of stator blades; (3) numerical integration of the equation of motion of drops traveling along various wake streamlines and the estimation of secondary atomization effects; and (4) solution of drop impact velocity triangles to provide information on the magnitude of the normal component of impact velocity and the physical location of erosion. Author

N69-19057*# Lockheed Propulsion Co., Redlands, Calif.
LOCKSEAL STUDY FOR 260-INCH DIAMETER LARGE SOLID MOTOR
12 Sep. 1968 97 p refs
(Contract NAS7-707)
(NASA-CR-100147; LPC-952-F) Avail: CFSTI CSCL 21H

The planning of a demonstration test program is described that will provide the most meaningful and economical approach to the test of the Lockseal nozzle. The effort considered both the bench testing and hot firing of a half length motor Lockseal, making maximum use of existing hardware. For this Lockseal design, all design analyses and elastomer development work have been completed. Furthermore, Poseidon experience represents thorough subscale characterization of the basic design. As indicated, an assumption is made as to the availability of a Lockseal unit of the design developed under the previous contract. The demonstration test program plan was developed generally around the assumption that the Lockseal fabrication or testing could be accomplished by any large motor contractor. The costs developed and presented in this report are order-of-magnitude, but in sum are estimated to be within 10 percent of a firm number. Author

N69-19073*# Martin Co., Denver, Colo.
STERILIZABLE LIQUID PROPULSION SYSTEM Quarterly Progress Report
S. C. Lukens Jan. 1969 37 p Prepared for JPL
(Contract NAS7-100; JPL-951709)
(NASA-CR-100215; MCR-67-15; QPR-8) Avail: CFSTI CSCL 21H

The purpose of this program was to design, fabricate, and make a demonstration firing of a fueled bipropellant liquid propulsion module capable of withstanding exposure to a sterilization environment. This report covers efforts on a new equatorial diaphragm joint design and a modified trap design. The trap device has been successfully tested in a negative lg regime. Diaphragm failures have been incurred due to stretching the Teflon membrane to conform to the tank wall. An extension to the materials compatibility test program is described. Author

N69-19400*# Bendix Corp., Davenport, Iowa. Instruments and Life Support Div.
DEVELOPMENT OF AN SPS/DPS HYDROGEN SHROUDED CRYOGENIC HELIUM STORAGE SYSTEM Summary Report
W. B. Bald 18 Oct. 1968 19 p
(Contract NAS9-7337)
(NASA-CR-99536; PUBL-4140-68) Avail: CFSTI CSCL 21H

The shroud tankage method of helium gas storage was examined at a higher temperature and pressure using a secondary cryogenic fluid as a refrigerant surrounding the primary fluid contained within the inner vessel. The objectives are to upgrade the shroud tank concept to meet lunar module descent propulsion systems requirements, and develop a dewar container to meet prolonged prelaunch and onboard standby requirements. A vacuum void exists between the helium tankage assembly and the enclosing outer shell thus reducing the environmental heat leak to a mainly radiative heat transfer mode. The increase in total equilibrium heat leak which occurred between the LH_2 vented heat leak data and the pressure buildup data during thermal tests was attributed to increased bumper contact caused by pressure expansion of the inner vessel. This design problem can be eliminated by preloading the bumper suspension system during assembly. J.L.H.

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N69-18551 Rochester Univ., N. Y.
AN EXPERIMENT TO DETECT PRIMARY COSMIC GAMMA RAYS
Roland William Cobb (Ph.D. Thesis) 1968 128 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-9362

This thesis describes an experiment in which an attempt was made to detect primary, point source cosmic gamma rays using a spark chamber counter system. Evidence is presented for a possible point source gamma ray flux from the constellation of Cygnus. It is shown that, during the experiment, an unexpected shift in the counting rate occurred for a class of detected events which could not be identified as being gamma ray initiated. The results of an examination of the properties of all events detected during the shift are described. Dissert. Abstr.

N69-18587# Rome Univ. (Italy). Lab. di Astrofisica.
SOUNDING ROCKET EXPERIMENT LAUNCHED FROM AN EQUATORIAL BASE FOR THE ANALYSIS OF NON-SOLAR X-RAY SOURCES [ESPERIMENTO DI LANCIO DI UN RAZZO SONDA DA UNA BASE EQUATORIALE PER LO STUDIO DELLE SORGENTI X EXTRA-SOLARI]
Sep. 1968 9 p In ITALIAN *Its* Ser. Spaziale N. 1
(REPT.-68/4) Avail: CFSTI

In 1966 the 'Laboratorio di Astrofisica di Frascati' Italy began the preparation of a Nike-Apache rocket experiment to be launched from the S. Marco equatorial platform. The experiment planned for early 1969, is described and details of the payload, instrumentation and telemetry are given. ESRO

N69-19048# Travelers Research Center, Inc., Hartford, Conn.
RESEARCH ON THE THEORY OF CLIMATE. VOLUME 2: LONG-PERIOD GLOBAL VARIATIONS OF INCOMING SOLAR RADIATION Final Report
Anandu D. Vernekar May 1968 292 p refs
(Contract E22-137-67(N))
(PB-180154-Vol-2; TRC-7047-312b) Avail: CFSTI

Results are given of an improved calculation of the Milankovitch radiation chronology. The results are presented in a form which can be directly applied in dynamical models of climatic change. USGRDR

N69-19054*# Naval Aerospace Medical Inst., Pensacola, Fla.
COMPARATIVE EVALUATION OF THE RADIATION ENVIRONMENT IN THE BIOSPHERE AND IN SPACE
Hermann J. Schaefer 13 Dec. 1968 23 p refs
(NASA Order R-75)
(NASA-CR-100031; NAMI-1054) Avail: CFSTI CSCL 20H

The radiation environment of the biosphere and that of the outer space were compared in order to arrive at a maximum dose rate for manned space operations. Radiation levels in the biosphere range from lowest levels of 6 microrem/hr over the ocean to more than 300 times higher in areas of Brazil and India. These high levels overlap the lowest in space as long as only regions outside the radiation belt and conditions of a Quiet Sun are considered. By building shelters of indigenous rock on the moon or planets for solar proton storm protection, man's long term survival appears to be assured as related to ionizing radiation. Inconspicuous chronic damage, such as shortening the life span, resulting from galactic radiation exposure in space is difficult to assess quantitatively, although data on this subject have been extrapolated using mice exposed to gamma rays and neutrons. As related to acute effects from trapped or flare-produced protons, the greatest operational problem is treatment and alleviation of discomfort from skin erythema, and possibly more severe skin damage, resulting from medium high doses which would leave more deeply seated organs and tissues intact because of the lower depth doses of this type of radiation. A.C.R.

N69-19145# Aerospace Corp., El Segundo, Calif. Lab. Operations.
FLARE VIDEO ANALYZER
Thomas J. Janssens 26 Feb. 1969 19 p refs
(ATR-69(8106)-2) Avail: Issuing Activity

A design is presented of a low cost operational system, called a flare video-analyzer, for detecting flares and recording in real time their position, area, brightness, and total photometry. The system includes a small computer that samples a standard television signal of the sun in $H\alpha$. Instead of a brightness comparison or point-by-point comparison, this system detects and measures flares by measuring and comparing the distribution functions of the active regions. A sample flare analysis program is presented. As a research instrument, the system is applicable to a wide range of measurements when suitably programmed. Equipped with a suitable filter and electro-optic crystal, this device could be used to measure magnetic fields. Author

N69-19191# Universidad Mayor de San Andres, La Paz (Bolivia). Laboratorio de Fisica Cosmica.
SUMMARY OF WORK FOR 1967 [RESUMEN DE LABORES, 1967]
Oscar Saavedra, ed. Mar. 1968 231 p refs In SPANISH *Its* Quarter Report No. 31
Avail: CFSTI

Summaries of publications for the work accomplished on projects in 1967 are presented. Articles on the following subjects are included: (1) air shower activity, and high energy nuclear reactions, (2) space physics, (3) quarks, and (4) subjects presented at conferences. Transl. by F.O.S.

N69-19195# Los Alamos Scientific Lab., N. Mex.
VELA-4 SATELLITE ENERGETIC PARTICLE EXPERIMENT
S. Singer, W. P. Aiello, J. P. Conner, and R. W. Klebesadel [1968] 16 p refs Presented at the 15th Nucl. Sci. Symp., Montreal
(Contract W-7405-ENG-36)
(LA-DC-9627; CONF-681017-3) Avail: CFSTI

The Vela-4 satellite energetic particle experiment consists of a pair of diffused-junction semiconductor detectors for electrons in the energy range 30–600 keV, and a guarded, four-element, solar particle telescope for detecting protons from 0.5 to 100 MeV and alpha particles from 3.6 to 380 MeV in 13 differentially-counted channels. Separation of protons from alpha particles is accomplished by an in-flight particle identifier. Two additional simplified telescopes are used to extend the angular coverage of the primary telescope, and a wide angle, high sensitivity scintillation detector is employed to monitor low intensity solar particle events. The design and operation of these instruments are described. Author (NSA)

N69-19199# Universidad Mayor de San Andres, La Paz (Bolivia). Laboratorio de Fisica Cosmica.
THE SCIENTIFIC INVESTIGATION IN THE COSMIC PHYSICS LABORATORY [LA INVESTIGACION CIENTIFICA EN EL LABORATORIO DE FISICA COSMICA]
G. R. Mejia Oct. 1968 30 p refs In SPANISH
Avail: CFSTI

The location of the cosmic laboratory on Mont Chacaltaya at an altitude of 5200m, with excellent visibility, on the geomagnetic equator, and atmospheric density approximately half of that at sea level is discussed. These advantages are considered unique for investigation of cosmic rays and nuclear physics of high energy particles. Descriptions of the available equipment and current experiments are included. Among the theoretical studies are: spark chambers, nuclear explosions, and radio waves. Meteorological studies of the upper atmosphere are also being investigated. Transl. by F.O.S.

N69-19402# Universidad Mayor de San Andres, La Paz (Bolivia). Laboratorio de Fisica Cosmica.
ON THE PHYSICAL SIGNIFICANCE OF THE UNUSUAL WORLD-WIDE FLUCTUATIONS OF COSMIC RAY INTENSITY ON JULY 14–15, 1961
H. S. Ahluwalia, M. Zubieta, and M. Schreier *In its* Sci. Contrib. of Space Phys. Group to Intern. Conf., Dec. 1967 43 p refs Presented at the 10th Intern. Conf. on Cosmic Rays, Calgary, Can., 18–29 Jun. 1967 (See N69-19401 08-30)
(Grant AF-AFOSR-319-66)
Avail: CFSTI

We have examined the characteristics of the unusual world-wide fluctuations of cosmic ray intensity on July 14–16, 1961 using corrected hourly data from global network of neutron and meson detectors as well as the reported data of Satellite Injun I. A careful study of the associated, solar interplanetary and geophysical phenomena leads us to recognise the dominant role played by the Interplanetary Magnetic Field Inhomogenities (IMFI) in modulating galactic cosmic ray flux received at earth during recovery from Forbush decreases. Phenomenological considerations lead us to believe that energetic storm particles are either the manifestation of a "quasi-trapped" component of solar cosmic rays which get temporarily confined within microstructures in a blast wave or else they represent part of energetic particles generated on the sun for several tens of hours after the visible traces of optical solar flare have vanished. Author

N69-19404# Universidad Mayor de San Andres, La Paz (Bolivia). Laboratorio de Fisica Cosmica.
THE INCREASE IN LOW ENERGY COSMIC RAY INTENSITY ON JULY 7, 1966

H. S. Ahluwalia, L. V. Sud, and M. Schreier *In its* Sci. Contrib. of Space Phys. Group to Intern. Conf. Dec. 1967 17 p refs Presented at the 10th Plenary Meeting of COSPAR, London, 17–29 Jul. 1967 Submitted for publication (See N69-19401 08-29)
(Grant AF-AFOSR-319-66)
Avail: CFSTI

Some stations of the high-latitude network of high counting rate neutron monitors with vertical cut-off rigidity ≤ 2.3 GV registered a sharp simultaneous and rather conspicuous small increase between 0100–1300 UT on July 7, 1966. Meson telescopes at same sites did not observe any increase. The increase is the smallest ever recorded by ground-level detectors and is associated with class 2B solar flare which occurred in McMath plage region 8362 at 0020 UT the same day with helio-coordinates: N34W47. The flare thus turns out to be in the most northernly location ever observed which produced increase of cosmic ray intensity in ground-level detectors. It is conjectured that solar protons which produced the ground-level increase reached earth after considerable scattering—they might have been deviated over 30° from the radial direction. Implications on prevalent interplanetary magnetic field configuration and propagation characteristics of solar protons are discussed. Author

N69-19466# Tokyo Astronomical Observatory (Japan).
BULLETIN OF SOLAR PHENOMENA, January–March 1968
Mar. 1968 30 p *Its* Bull. Vol. 20, No. 1, p 1–30
Avail: CFSTI

Tabulated data and diagrams are presented of sunspot activity, solar flares, prominences and filaments, the intensity of coronal emission line 5303 Å, and solar radio emission. Observation time tables are included. K.W.

N69-19582# National Lending Library for Science and Technology, Boston Spa (England).
FLUCTUATIONS IN THE SOLAR IRRADIATION OF THE EARTH DUE TO SECULAR VARIATIONS IN THE ELEMENTS OF THE EARTH'S ORBIT
S. G. Saraf et al 1968 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk (Moscow), v. 182, no. 2, 1968 p 291–293
(NLL-M-7493-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

A comparison of solar winter irradiation totals for a given latitude at different dates in the geological past with the insolation total obtained for the same latitude during the winter half year at present is used to determine climatic fluctuations during the whole time interval. Trigonometrical precessing formulae are utilized to determine the constants and coefficients of the trigonometrical series obtained and to calculate the secular variations of the elements of the earth's orbit for 30 million years up to 1950. Results are used to obtain summer and winter insolation tables for latitude 65° in each hemisphere and the corresponding graphs of total secular radiation variations. Included are example graphs for 65° latitude insolation over the last 3 million years. G.G.

N69-19583# National Lending Library for Science and Technology, Boston Spa (England).
ON THE PROBLEM OF THE INFLUENCE OF LOCAL FACTORS ON THE RECEIPT OF RADIATION IN A MOUNTAINOUS DISTRICT
I. I. Borzenkova [1968] 15 p refs Transl. into ENGLISH from Glav. Geof. Obs. (Leningrad), no. 209, 1967 p 70–77
(NLL-M-7467-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

The author considers the problem of the difference between the influxes of radiation on slopes exposed in different directions (north–south) at two different heights above sea level. She knows the differences between the temperature of the underlying surfaces of differently orientated slopes, and attempts to assess the influence of the elevation of the horizon on the influx of total radiation and long-wave emission from data obtained in the Alps. Author

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N69-18301*# Arizona Univ., Tucson.
COMMUNICATIONS OF THE LUNAR AND PLANETARY LABORATORY, COMMUNICATIONS NOS. 105–111, VOLUME 7, PART 1
Gerard P. Kuiper, ed. 1967 55 p refs
(Grant NsG-161)
(NASA-CR-99702) Avail: CFSTI CSCL 03B

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1. WAVELENGTH DEPENDENCE OF POLARIZATION. 9: INTERSTELLAR PARTICLES T. Gehrels p 1–11 refs (See N69-18302 08-30)

2. WAVELENGTH DEPENDENCE OF POLARIZATION. 10: INTERSTELLAR POLARIZATION G. V. Coyne and T. Gehrels p 13–24 refs (See N69-18303 08-30)

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4. POLARIMETRY FROM HIGH-ALTITUDE BALLOONS G. V. Coyne and T. Gehrels p 33–38 refs (See N69-18305 08-30)

5. THE POLARISCOPE BALLOON-BORNE SERVO SYSTEM J. E. Frecker p 39–44 refs (See N69-18306 08-14)

6. A MECHANICAL COORDINATE CONVERTER G. V. Biesbroeck and T. Gehrels p 45–46 (See N69-18307 08-14)

7. THE DESIGN OF LOW-COST PHOTOMETRIC TELESCOPES H. L. Johnson p 47–55 ref (See N69-18308 08-14)

N69-18302*# Arizona Univ., Tucson.
WAVELENGTH DEPENDENCE OF POLARIZATION. 9: INTERSTELLAR PARTICLES
Thomas Gehrels *In its* Commun. of the Lunar and Planetary Lab., Commun. Nos. 105–111, Vol. 7, Pt. 1 1967 p 1–11 refs Repr. from Ast. J., v. 72, no. 5, Jun. 1967 *Its* Commun. No. 105 (See N69-18301 08-30)
Avail: CFSTI CSCL 03B

Comparison of the wavelength dependence of interstellar polarization with that observed in reflection nebulae appears to rule out metallic and purely graphitic grains for the general interstellar medium. The observations on reflection nebulae are best explained with composite grains that have an absorptive nucleus of diameter 0.05 μ and an icy shell of diameter 0.3 μ. The visual albedo of the grains is near 0.5 and the asymmetry factor 0.6. Because of this asymmetry, reflection nebulae generally are not observable if the star is in front of the nebula. NGC 7023 has 4×10^{-13} grains/cm^3 and the visual optical depth within the nebula is only 0.2. Author

N69-18303*# Arizona Univ., Tucson.
WAVELENGTH DEPENDENCE OF POLARIZATION. 10: INTERSTELLAR POLARIZATION
G. V. Coyne and T. Gehrels *In its* Commun. of the Lunar and Planetary Lab., Commun. Nos. 105–111, Vol. 7, Pt. 1 1967 p 13–24 refs Repr. from Ast. J., v. 72, no. 7, Sep. 1967 *Its* Commun. No. 106 (See N69-18301 08-30)
(Grants NsG-670; NsG-733)
Avail: CFSTI CSCL 03B

A survey of O and B stars was started with the new 154cm Catalina reflector. The equipment is described and results are given for 33 stars. Of these, seven stars show variable polarization. Striking discrepancies from the mean interstellar polarization-wavelength dependence are found near Orion. The brighter component of θ^2 Orionis, a spectroscopic binary with a 21-day period, shows variations of ±0.5% in the ultraviolet. The spectroscopic binary ϕ Per shows variations of about ±0.2%. Both stars have a strong wavelength dependence of the polarization position angles. A time dependence of the position angle is found for the spectroscopic binary and shell star ζ Tau. Author

N69-18306*# Arizona Univ., Tucson.
POLARIMETRY FROM HIGH-ALTITUDE BALLOONS
G. V. Coyne and T. Gehrels *In its* Commun. of the Lunar and Planetary Lab., Commun. Nos. 105–111, Vol. 7, Pt. 1 1967 p 33–38 refs *Its* Commun. No. 108 Supported in part by NASA and by NSF (See N69-18301 08-30)
Avail: CFSTI CSCL 20F

The ballooning is for an extension of the ground based polarimetry of planetary atmospheres and interstellar matter to wavelengths shorter than 3000 Å. Some of the largest available balloons are used to carry telescopes to an altitude of 36 km, which is above a sufficient fraction of the terrestrial ozone to allow polarimetry with ± 0.03% precision at 2850 and 2250 Å. The development of and operations with two gondolas are described, one gondola has two 7.5 cm telescopes and the other has a 71-cm telescope. Author

N69-18309*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SURVEYOR 7 MISSION REPORT. PART 1: MISSION DESCRIPTION AND PERFORMANCE
15 Feb. 1969 241 p refs
(Contract NAS7-100; Proj. Surveyor
(NASA-CR-99901; JPL-TR-32-1264-Pt-1) Avail: CFSTI CSCL 22A

Surveyor 7, the last in a series of seven unmanned spacecraft designed to soft-land on the moon and return engineering and scientific data, was launched from Cape Kennedy, Florida, on January 7, 1968. All established objectives for the mission were achieved. Following a nominal lunar transit phase, a completely successful soft landing was achieved on the ejecta or flow blanket north of the crater Tycho in the lunar highlands at 40.92°S latitude and 11.45°W longitude. Surveyor 7 performed extensive operations and experiments before shutdown after sunset of the first lunar day and also was operated for a considerable period of time during the second lunar day. A large quantity of high-quality television pictures were obtained from the rock-strewn surface on which the spacecraft landed. In addition, other new information was obtained, including data on the chemical composition of the lunar surface from operation of an alpha scattering instrument and data on the physical properties of the lunar surface from operation of soil mechanics/surface sampler. This was the first mission on which both these instruments were carried. The surface sampler was used to overcome a problem with deployment of the alpha scattering instrument and also to redeploy it on the lunar surface. Author

N69-18310*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SURVEYOR 7 MISSION REPORT. PART 3: TELEVISION DATA
T. H. Bird, M. I. Smokler, and D. L. Smyth 1 Sep. 1968 334 p refs
(Contract NAS7-100; Proj. Surveyor)
(NASA-CR-99762; JPL-TR-32-1264-Pt-3) Avail: CFSTI CSCL 22A

A selection of 290 pictures relating to the Surveyor 7 mission is included. Copies of selected mosaics of the information collected by the TV camera are presented. Spatial relationships among various features on the lunar surface are evaluated by reference to the mosiac of the area of interest. The most direct means of locating individual items of interest is by reference to camera azimuth and elevation and the associated mosaic areas. Also included are several special mosaics showing areas of particular interest. The television system, orientation of camera and sun, and recording systems are described. Author

N69-18592 California Univ., Berkeley.
COSMOGENIC, RADIOGENIC, AND FISSIOGENIC RARE GASES IN IRON METEORITES AND ACHONDRITES
Miner Nelson Munk (Ph.D. Thesis) 1967 60 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-10378

Three papers on rare gas anomalies in meteorites are presented. Paper 1 presents the measured abundances of the 21 stable isotopes of neon, argon, krypton, and xenon in the Costilla Peak iron, meteorite. A pronounced spallation component is observed in all four of the gases and neon and argon results agree with previous iron meteorite measurements. Paper 2 presents the measured neon, argon, krypton, and xenon compositions in the medium octahedrites Misteca and Carbo. A substantial Xe^{129} component, and to a lesser extent a Xe^{131} component, in excess of the trapped and spallation components is observed in Carbo xenon. The same agreement between observed and calculated spallation compositions as seen in the Costilla Peak medium octahedrite is found and attributed to different degrees of cosmic ray shielding in the meteorites. Paper 3 presents the argon, krypton, and xenon analyses of the calcium and uranium rich achondrites Angra dos Reis and Nuevo Laredo. Results for the Norton County aubrite show good agreement with previously reported analyses from other laboratories. Spontaneous fission of U^{238} makes the largest known contributions to the fission xenon in these meteorites. The large amount of fission xenon and the low ratio of fission Kr^{86} to fission Xe^{136} both support the hypothesis that a major fraction of the fission xenon is due to the extinct radioactivity Pu^{244} Dissert. Abstr.

N69-18659*# Centre National de la Recherche Scientifique, Verrières-le-Buisson (France). Service d'Aéronomie.
INTRODUCTION TO SPACE PHYSICS [INTRODUCTION A LA PHYSIQUE DU MILIEU SPATIAL]
G. Israel Paris CNES, 1968 116 p refs In FRENCH Presented at the CNES Symp. on Space Technol., Bretigny, France, 12 Mar.–2 Apr. 1968
Avail: CFSTI

Both the scientific and the technological aspects of space physics are considered in this report. The first part deals with the characteristics of the space environment out to the interplanetary distances whilst the second part deals in detail with the regions nearer the earth, particularly the effects of electromagnetic and corpuscular radiation. ESRO

N69-18685*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE INFRARED INTERFEROMETER SPECTROMETER EXPERIMENT FOR THE MARS MARINER 1971 ORBITAL MISSION

R. A. Hanel, B. J. Conrath, W. A. Hovis, V. Kunde, P. D. Lowman, C. Prabhakara, B. Schlachman, and G. V. Levin (Biospheric Res., Inc.) Feb. 1969 31 p refs

(NASA-TM-X-63464; X-620-69-35) Avail: CFSTI CSCL 03B

Use of the infrared interferometer spectrometer on a Mars orbiting spacecraft provides an opportunity for inferring spatial and temporal behavior of various physical parameters associated with the planetary atmosphere and surface. Included among these parameters are atmospheric and surface temperatures and total atmospheric water vapor content. A search can be made for minor atmospheric constituents which are optically active in the spectral range of the observations. Information on the types of surface materials present can be obtained from the phenomenon of reststrahlen, and analyses of cooling curves should also be useful in surface studies. To illustrate the information content of the interferometer measurements, examples of synthetic spectra calculated using model atmospheres are given. Techniques for obtaining the various physical parameters from measured spectra are discussed. Preliminary analysis indicates that water vapor amounts as low as 0.1 precipitable microns should be detectable under reasonable assumptions on the behavior of the atmospheric temperature profile. Author

N69-18706# Royal Aircraft Establishment, Farnborough (England).

USE OF THE MOON'S ATTRACTION TO ACCELERATE A SPACECRAFT TO HYPERBOLIC FLIGHT

H. Hiller Aug. 1968 22 p refs

(RAE-TR-68203) Avail: CFSTI

A study has been made of the trajectories required for a spacecraft spiralling out to the vicinity of the Moon under the action of microthrust and then utilizing the Moon's gravitational attraction to accelerate it to hyperbolic speed relative to the Earth, i.e. into a heliocentric orbit. The spacecraft must move round the Earth in the opposite sense to the Moon and can only enter the Moon's sphere of influence through one of two narrow windows close to the Moon's orbit. The subsequent orbit about the Sun can have an aphelion distance of up to 1.17 A.U. or a perihelion distance as low as 0.86 A.U. The use of the Moon's attraction alters the speed by up to 4% or the semi major axis by up to 9%. Author (ESRO)

N69-18727# European Space Operations Center, Darmstadt (West Germany).

SOME ASPECTS OF THE ASTRONOMICAL OBSERVATION SCHEDULING FOR THE LARGE ASTRONOMICAL SATELLITE

H. A. Kellner Paris ESRO Apr. 1968 19 p refs

(ESRO-SM-74(ESOC)) Avail: CFSTI

Basic features, such as the star catalogue and the required planetary ephemeris tape system, are first discussed. The main problem, that of the observing constraints and their implications, is then considered. The most complicated constraint arises from the Earth's occultation and alone amounts to 40-60 per cent, varying rapidly with a period of 100 minutes, thereby dictating the fundamental rhythm of operation. It is proposed that the exceedingly simple two-or three-object modes of scheduling observations be pragmatically established as the underlying principle of operating the observatory system. Author (ESRO)

N69-18757# Royal Aircraft Establishment, Farnborough (England).

EVOLUTION OF COMMENSURABILITIES BETWEEN NATURAL SATELLITES

R. R. Allan Jul. 1968 31 p refs

(RAE-TR-68169) Avail: CFSTI

There are a number of pairs of natural satellites whose mean motions are nearly commensurable and it is readily shown that there is a long-term energy transfer between the two satellites only if the orbit of at least one is appreciably eccentric or inclined. When the motion of the node(s) or peri-centre(s) is included, it becomes clear that at least some of these near-commensurabilities are in reality exact in that their motions are locked together and the satellites are librating about a stable configuration. The driving force which has formed these commensurabilities, and which also dissipates the relative energy of libration, is tidal friction with the planet. This paper considers specifically the commensurability between two of Saturn's satellites, Mimas and Tethys, which seems to be the only example which involves the inclinations and nodes rather than the eccentricities and apses. It is shown that the inner satellite is pushing out the outer one, and that the inclinations of both are necessarily increasing. It follows that the commensurability could not have existed when the semi-major axes were less than 0.9915 of their present values. Numerical integration of the libration amplitude indicates that it was actually formed when the semi-major axes had 0.9922 of their present values, and the inclinations of the inner and outer satellites were 0°.4 and 1.0° respectively. This probably occurred about 2.2×10^8 years ago. (Author (ESRO)

N69-18758# Royal Aircraft Establishment, Farnborough (England).

A DETERMINATION OF THE ORBIT OF SECOR 6 ROCKET (1966-51A)

Diana W. Scott Jul. 1968 23 p refs

(RAE-TR-68170) Avail: CFSTI

36 sets of orbital parameters for 1966-51A have been obtained using optical and radar observations made between June and October 1966. The results should be useful in studies of the density and rotational speed of the upper atmosphere. Author (ESRO)

N69-18778# Technische Hochschule München (West Germany). Inst. für Mechanik.

QUASI-OPTIMUM SINGLE-AXIS CAPTURE OF A SATELLITE

W. Schielen [1968] 13 p refs Presented at the CNES Intern. Colloq. on Satellite Attitude and Stabilization, Brétigny, France, 8–11 Oct. 1968

Avail: CFSTI

The problem of minimum time capture of a satellite spinning about the pitch axis is examined. Low thrust jets fixed in the satellite are used to achieve the capture and thus the gravity gradient phenomenon has to be considered. A comparison with the optimum case shows that the simplicity of the control device is off-set by a partial loss of quality. ESRO

N69-18779# Royal Inst. of Tech., Stockholm (Sweden). Plasma Physics Div.

ANTIMATTER, QUASI-STELLAR OBJECTS AND THE EVOLUTION OF GALAXIES

H. Alfven and A. Elvius Sep. 1968 25 p refs

(Rept.-68-15) Avail: CFSTI

Astronomical observations indicate that there is a continuous sequence of objects from quasistellar objects via N-galaxies, Seyfert galaxies, radio galaxies to ordinary galaxies. The sequence as an evolutionary pathway is interpreted. Accepting this view the total energy released during the life-time of a galaxy is so large that the most likely source is annihilation. The demand for symmetry in the universe between koinomatter and antimatter indicates that there must be equal quantities of the two kinds of matter in every galaxy. From this it seems likely that a galaxy is born as an

ambiplasma body, which releases very much energy by annihilation. Separation of the ambiplasma into koinomatter and antimatter in reasonably stable configurations, and the burning out of the non-separated ambiplasma should be the main processes which govern the evolution from protogalaxies, and quasi-stellar objects to ordinary galaxies. ESRO

N69-18783# Rome Univ. (Italy). Lab. di Astrofisica.
PLANAR COLLIMATION FOR CELESTIAL OBSERVATION BY ROTATING SPACECRAFT [LA COLLIMAZIONE AD UN PIANO NELLA ESPLORAZIONE DEL CIELO A MEZZO DI VEICOLI SPAZIALI RUOTANTI]
M. Amoretti Sep. 1968 17 p In ITALIAN *Its* Ser. Spaziale N. 2
(REPT.-68/5) Avail: CFSTI

Planar collimation is described for locating weak X-ray sources using instruments on a spinning vehicle. The exploration must be carried out by at least two similar units with the axis of counter-collimator being at an angle to the axis of rotation. Such orientations may affect the precision and sensitivity of the instruments. The problem of optimizing the orientation is also considered. ESRO

N69-18805# Rome Univ. (Italy). Scuola di Ingegneria Aerospaziale.
ASCENT TRAJECTORY OF SAN MARCO 2 SATELLITE [LA TRAIETTORIA DI LANCIO DEL SAN MARCO 2]
Michele Sirinian Jun. 1968 22 p refs In ITALIAN; ENGLISH summary *Its* ATTI del Centro Ric. Aerospaziale No. 15-g
Avail: CFSTI

The ascent trajectory of the Scout 153 c vehicle which launched the Italian satellite San Marco II into an equatorial orbit is discussed. After a brief description of the vehicle, the launch site and the ground instrumentation, the special requirements of the trajectory are listed and the solutions used are presented. Diagrams of the main parameters versus time and the nominal trajectory of the vehicle are given. Author (ESRO)

N69-18829# Group de Recherches Ionosphériques, Paris (France).
MEASUREMENT OF IONIC AND ELECTRONIC PARAMETERS IN IONOSPHERIC AND INTERPLANETARY PLASMAS BY MEANS OF PROBES [MESURES DES PARAMETRES IONIQUE ET ELECTRONIQUE DES PLASMAS IONOSPHERIQUE ET ENTERPLANETAIRE AU MOYEN DE SONDES]
J. Kaprelian (Centre Natl. de Rech. Spatiales) 8 Mar. 1968 53 p refs In FRENCH Presented at the CNES Symp. on Space Technol., Bretigny, France, 12 Mar.–2 Apr. 1968
Avail: CFSTI

The characteristics of plasmas are first reviewed in some detail. The Langmuir probe is then described and its limitations are discussed, e.g. the problems relating to the reference potential, the thickness of the plasma sheath, secondary emissions, and the reflection of charged particles at the surface of the probe. The perturbations of the motion of particles in a magnetic field are analyzed along with the plasma vehicle interactions. Ionization, resonance, and impedance probes are all analyzed and ways of simulating aerospace plasma conditions in a laboratory so as to calibrate them are indicated. ESRO

N69-18883*# Northeastern Univ., Boston, Mass.
THEORETICAL STUDY OF ANTENNA PROBLEMS IN RADIO ASTRONOMY Final Report, Jul. 1, 1963–Sep. 1, 1967
Sheldon S. Sandler [1968] 4 p refs
(Grant NsG-355)
(NASA-CR-100078) Avail: CFSTI CSCL 03A

Single lag computations were performed for the satellite borne traveling wave V-antenna to show the variation in antenna current with load resistor and frequency. A new theory was developed for driving point impedance of the complete V-antenna based on the current of one lag; the solution is based on the antenna integral equation. Theoretical junction corrections derived indicated their importance for coupling between transmission line and antenna in high frequency models. Expressions were obtained for the spatial temperature distribution of the radio astronomical source as measured at antenna terminals. A theoretical study on impedance properties of a plasma filled capacitor was made and a general theory for functional representation of currents on electrically long linear antennas was initiated. G.G.

N69-18961*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE TEMS APOLLO-SATURN 5 RESULTS THROUGH THE AS-502 FLIGHT TEST
Bobby Junkin 3 Dec. 1968 75 p refs
(NASA-TM-X-53804) Avail: CFSTI CSCL 22C

Truncated tracker error models for representing the systematic errors on the Apollo-Saturn AS-501 and AS-502 flight tests are presented. The Tracking Error Model Studies (TEMS) method for determining the models involves establishing the tracker errors and then determining, in the least squares sense, functional expressions to describe the established errors. Guidelines used in obtaining the truncated error models have resulted in generally acceptable models for the AS-501 and AS-502 data. Although C band radar error models are used in the TEMS development, the method can be adapted to other types of tracking systems. Author

N69-19036*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE SURVEYOR 3 AND SURVEYOR 4 FLIGHT PATHS AND THEIR DETERMINATION FROM TRACKING DATA
W. J. O'Neil, R. G. Labrum, S. K. Wong, and G. W. Reynolds 15 Aug. 1968 113 p refs
(Contract NAS7-100)
(NASA-CR-100217; JPL-TR-32-1282) Avail: CFSTI CSCL 22C

The current best estimate of the *Surveyor III* and the *Surveyor IV* spacecraft flight paths and the way in which they were determined are described. The inflight orbit determination analysis is presented. The results of inflight and postflight analyses on the tracking data are presented along with the determination of certain physical constants and station locations. Author

N69-19062*# Ohio State Univ., Columbus. ElectroScience Lab.
THEORETICAL STUDY OF V ANTENNA CHARACTERISTICS FOR THE ATS-E RADIO ASTRONOMY EXPERIMENT Final Report
J. H. Richmond 13 Feb. 1969 101 p refs
(Contract NAS5-11543)
(NASA-CR-100153; Rept-2618-1) Avail: CFSTI CSCL 09F

A theoretical analysis has been carried out for the V antenna system on the ATS-E Satellite for radio astronomy experiments. This report summarizes the techniques and presents numerical results for impedance, current distributions, patterns and radiation efficiency. Author

N69-19063* Boeing Co., Seattle, Wash.
BROKEN PLANE MARS TRAJECTORY STUDY Final Report
Feb. 1969 268 p refs
(Contract NAS1-7995)
(NASA-CR-66741; D2-140028-6) Avail: CFSTI CSCL 22C

Broken plane interplanetary trajectories were studied for use on 1973 Mars orbiting missions. The analysis includes the effects of insertion into two specifically oriented orbits at Mars. The

results indicate that significant performance advantages and mission design flexibility are derived from the use of broken plane trajectories. In addition to the 1973 analysis, a preliminary evaluation was made of a 1975 mission. The advantages of broken plane trajectories were even more significant for this mission. Author

N69-19104*# Interior Dept., Washington, D. C. Geological Survey.
A TEST OF COURT-STENOGRAPHIC TECHNIQUES FOR RECORDING GEOLOGIC DESCRIPTIONS
David Schleicher Nov. 1968 15 p ref Sponsored by NASA *Its* Astrogeol. 10
(NASA-CR-100071) Avail: CFSTI CSCL 03B

Court-stenographic techniques for making a typed transcript of oral comments with very little delay were studied. A test was held to evaluate this possibility. One court reporter transcribed oral geologic descriptions on a shorthand typewriter (stenograph), and a second reporter translated the stenographic notes into a typed transcript. For the entire test, the average observed lag between the time a word was spoken and the time it was typed was about 72 seconds, and serious errors affected fewer than 4 percent of the words spoken in the test. No other technique tested has produced so accurate a transcript so promptly. Author

N69-19105*# Interior Dept., Washington, D. C. Geological Survey.
THE USE OF SPECTRAL ANALYSIS IN DESCRIBING LUNAR SURFACE ROUGHNESS
Wesley Rozema Dec. 1968 37 p refs *Its* Astrogeol. 12
(NASA Order W-12388)
(NASA-CR-100021) Avail: CFSTI CSCL 03B

The power spectral density (PSD) function has been investigated as a means of statistically describing land-surface roughness. Knowledge of the PSD functions of lunar topographic profiles is useful for analyzing the manner in which experimental lunar roving vehicles will respond to lunar terrain. In addition, the function enables comparison of the relative roughness of different types of terrain. Certain statistical problems are inherent in the determination of the PSD function. Methods of determining the function were selected and applied consistently to several terrestrial and lunar topographic profiles. Superposition of the graphs of these functions provides an intuitive comparison of the roughness of terrestrial and lunar terrains. Author

N69-19320*# Rice Univ., Houston, Tex. Dept. of Space Science.
FEASIBILITY STUDY OF LUNAR NEUTRON ALBEDO EXPERIMENT Final Scientific Report
Robert C. Haymes Jan. 1969 31 p refs
(Grant NGR-44-006-044)
(NASA-CR-100256) Avail: CFSTI CSCL 03B

A feasibility study is made on the effect on the slow and fast neutron counting rates due to increases in water content. A lunar neutron simulator, consisting of neutron detectors and a fast neutron source, measures the effect of water concentration on the ratio using a basiatic material like that found on the moon by the Surveyors. A sand-water mixture was also used in order to demonstrate the effects of differing elemental compositions in the sample. Data obtained using a 0.3% water content (by weight) in basalt indicate an increase of about 4% in the ratio over the 0.2% water content level. As expected from theory, the variation in ratio with water concentration is quite linear, for both samples tested. The only effect of variations in the elemental composition is to alter the slope of the line. Author

N69-19326# Grumman Aircraft Engineering Corp., Bethpage, N. Y.
EFFECT OF EARTH OBLATENESS AND EQUATOR ELLIPTICITY ON A SYNCHRONOUS SATELLITE
Chong-Hung Zee Dec. 1968 31 p refs
(FSR-AD6-06-68.4) Avail: Issuing Acitivity

Trajectories of a near-equatorial synchronous satellite under the influence of the oblateness (J_2) of a rotating Earth and its equatorial ellipticity ($J_2^{(2)}$) are derived by the asymptotic method in nonlinear mechanics. Since J_2 is of $O(10^{-3})$ and $J_2^{(2)}$ of $O(10^{-5})$, closed-form solutions for an improved second order (J^2_2) approximation are obtained. As an equatorial synchronous satellite may deviate from the equatorial plane of the Earth, either due to the perturbation of the Sun and the Moon or due to errors in establishing the synchronous orbit, the effects of the ellipticity of the equator on the osculating orbital elements of the resulting trajectories are also investigated. Author

N69-19378# Office National d Etudes et de Recherches Aerospatiales, Paris (France).
OPTIMAL TRANSFERS BETWEEN ELLIPTIC KEPLERIAN ORBITS (TIME-FREE CASE) [TRANSFERTS OPTIMAUX ENTRE ORBITS ELLIPTIQUES (DUREE INDIFFERENTE)]
Christian Marchal [1967] 132 p refs In FRENCH; ENGLISH summary *Its* Publ. No. 120(1967)
(PD-5796) Avail: CFSTI

In analyzing optimal transfers between elliptic Keplerian orbits, optimization theory is summarized, and the optimal conditions of rocket utilization are examined. Economy is defined as the minimum expense of propellant for a given transfer; therefore, the optimal conditions of rocket utilization are either the use of the maximum exhaust velocity or of a cut-off (according to the position along the orbit). These conditions lead to a cost parameter independant of the given rocket: the characteristic velocity. The following cases are studied in detail: (1) transfers between near-circular close orbits; (2) transfers between eccentric orbits; (3) transfers between equal orbits; (4) transfers between inverse (or opposing) coaxial orbits by perigee, by apogee, or by infinity; and (5) optimal transfers between coplanar orbits. Viewpoints are presented on rendezvous, bi-parabolic transfers which are considered useful for the case of large angles between the orbital planes, and the replacement of a theoretical impulse by one or several thrusting arcs. Author

N69-19401# Universidad Mayor de San Andres, La Paz (Bolivia). Laboratario de Fisica Cosmica.
SCIENTIFIC CONTRIBUTIONS OF SPACE PHYSICS GROUP TO INTERNATIONAL CONFERENCES
H. S. Ahluwalia, ed. Dec. 1967 82 p refs *Its* cuaderno no. 29
Avail: CFSTI

CONTENTS:

1. ON THE PHYSICAL SIGNIFICANCE OF THE UNUSUAL WORLD-WIDE FLUCTUATIONS OF COSMIC RAY INTENSITY ON JULY 14–15, 1961 H. S. Ahluwalia, M. Zubieta, and M. Schreier 43 p refs (See N69-19402 08-29)
2. SPACE ACTIVITIES IN BOLIVIA H. S. Ahluwalia 7 p refs (See N69-19403 08-30)
3. THE INCREASE IN LOW ENERGY COSMIC RAY INTENSITY ON JULY 7, 1966 H. S. Ahluwalia, L. V. Sud, and M. Schreier 17 p refs (See N69-19404 08-29)

N69-19403# Universidad Mayor de San Andres, La Paz (Bolivia). Laboratario de Fisica Cosmica.
SPACE ACTIVITIES IN BOLIVIA
H. S. Ahluwalia *In its* Sci. Contrib. of Space Phys. Group to Intern. Conf. Dec. 1967 7 p refs Presented at the 10th Plenary Meeting of COSPAR, London, 17–29 Jul. 1967 Submitted for publication (See N69-19401 08-30)
Avail: CFSTI

Theoretical and experimental research activities centered on physical characteristics of interplanetary and interstellar media.

Experiments in progress are related to characteristics of secondaries produced by primary cosmic rays and observation of solar corona during eclipse. Analyzed were: (1) deformed magnetic field effects on primary cosmic ray propagation; (2) physical characteristics of interplanetary medium; (3) propagation of solar cosmic rays in interplanetary medium; and (4) diffusion characteristics of galactic cosmic rays in connection with solar wind regions. G.G.

N69-19406*# Interior Dept., Washington, D. C. Twin Cities Mining Research Center.
MULTIDISCIPLINARY RESEARCH LEADING TO UTILIZATION OF EXTRATERRESTRIAL RESOURCES Quarterly Status Report, 1 Oct. 1968–1 Jan. 1969
Thomas C. Atchison 1 Jan. 1969 34 p
(NASA Order R-09-040-001)
(NASA-CR-98754) Avail: CFSTI CSCL 03B

Evaluation of current information on the lunar surface continued. Detailed results of the Surveryor VII landing in the lunar highlands are not yet available. However, preliminary results indicate no great differences in surface characteristics from those found in the maria landings. Good progress in the Apollo program is causing added effort in the many scientific studies related to the returned lunar samples expected from the first manned landing. In connection with the Surveyor simulation studies on our 14 simulated lunar rocks, several property studies have been carried out on fine particle samples of the rocks. Detailed studies were made of magnetic minerals in the rocks by measuring magnetic susceptibility, dielectric constant, and specific surfaces. Author

N69-19409*# Interior Dept., Washington, D. C. Geological Survey.
A LIMITATION OF FIRST GENERATION LUNAR ORBITER NEGATIVES AS APPLIED TO PHOTOCLINOMETRY
Neil Gambell and Baerbel K. Lucchitta Nov. 1968 13 p refs
Sponsored by NASA *its* Astrogeol. 11
(NASA-CR-100075) Avail: CFSTI CSCL 03B

A test was run in order to determine approximately the percentage of Lunar Orbiter first generation photographic negatives from Missions II and III that are useful for slope determination by the photoclinometric method. Classified graphs showed that a significant number of first generation negatives are completely unsuitable for photoclinometric reduction; many give unreliable slope information because the density ranges fall largely in the area of the upper gray scale limits, where small density differences represent large differences in slope. Author

N69-19410# Pennsylvania State Univ., University Park. Radio Astronomy Observatory.
A REPORT ON OBSERVATIONS OF JUPITER AT FREQUENCIES BETWEEN 3 AND 8 Mc/s Scientific Report, 1964–1965
F. R. Zabriskie and W. A. Solomon (Wesleyan Univ.) Dec. 1968 86 p refs
(Grant NSF GA-720)
(SR-016) Avail: Issuing Activity

This report describes in detail observations of Jupiter obtained in Connecticut during 1964 and 1965. The frequencies used ranged from 3.5 to 8.3 Mc/s. The descriptive features of Jupiter's decametric radiation — longitude profile, spectrum, and so on — are fairly well-known for frequencies above 15 Mc/s, and the quiet years of solar activity allowed studies to be made at frequencies where these general features were in dispute. This report contains a description of the equipment, the procedure used to analyze the records and identify Jovian emission, a catalogue of storms recorded, and a discussion of the behavior uncovered. Author

N69-19428*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SYSTEMS DIVISION
In its Space Programs Sum. No. 37-54, Vol. 3, Oct.-Nov. 1968 31 Dec. 1968 p 1-36 refs (See N69-19427 08-34)
Avail: CFSTI CSCL 22

Several trajectory and spacecraft parameters for a solar electric propulsion system applicable to a deep space asteroid probe are described. The purpose of a mission using this spacecraft would be to make: (1) an engineering test flight of a spacecraft using electric propulsion thrustors and lightweight rollout solar panels as a power source; and (2) a scientific investigation of the region of the solar system encompassing 2 to 3 AU, including the asteroid belt. A minimum thrustor operating time of 400 days at an initial power level of approximately 4.6 kW at 1 AU is desired. Progress toward establishing a numerically integrated lunar ephemeris is also reported. Particular emphasis is placed on evaluating the possible use of a modified version of the planetary Orbit Determination Program (PLOD) to fit the theory based ephemeris, designated LE 4. Finally, the effect of precession and nutation errors on radar observations is analyzed. Partial derivatives relating errors in the constant of general precession in longitude and the constant of nutation to changes in range and range rate are developed. A.C.R.

N69-19435*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ADVANCED STUDIES
In its Space Programs Sum. No. 37-54, Vol. 3, Oct.-Nov. 1968 31 Dec. 1968 p 230-238 (See N69-19427 08-34)
Avail: CFSTI CSCL 22A

Lunar mission planning is discussed from the standpoints of mission objectives, methods, types of experiments to be conducted, etc. Two tables are presented, the first of which describes the reasons for lunar exploration and the specific objectives in terms of major features or processes that have been studied on earth. The second table is an extension of the first and, insofar as is presently possible, includes detailed mission planning as to principal and secondary scientific experiments, with remarks where applicable. A.C.R.

N69-19502 Joint Publications Research Service, Washington, D. C.
ASTRONOMY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space No. 197 30 Jan. 1969 p 1-6 refs (See N69-19501 08-34)
Avail: CFSTI

Astronomical studies reported pertain to the solar magnetic field, and the determination of past astrophysical events by studying radiocarbons stored in wood. Attached abstracts of scientific articles describe a cosmological model for radio galaxies, emission spectra of supergiant stars and homogeneous rotating gas cylinders, and photographic observations of meteor orbits. G.G.

N69-19506# Joint Publications Research Service, Washington, D. C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space No. 197 30 Jan. 1969 p 45-68 refs (See N69-19501 08-34)
Avail: CFSTI

Lunar ground meter-penetrometer measurements performed by Luna-13 moon landing probe seem to indicate that the surface layer of the moon possesses uniform properties similar to terrestrial loose sands. Other space research activities centered on the development of life support systems, satellite launchings, meteor matter in interplanetary dust, and tektites. Included are a number of scientific abstracts on atmospheric phenomena. G.G.

N69-19527# Joint Publication Research Service, Washington, D. C.
ASTRONOMY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space No. 198 13 Feb. 1969 p 1–7 refs (See N69-19526 08-34)
Avail: CFSTI

Announced is the development of a high precision pendulum clock with instantaneously changing axis. The precision of the clock during a 24-hour period is 0.2 to 0.3 msec. A tectonic map of the visible and dark sides of the Moon is compiled to solve the problems of lunar tectonics. Attached abstracts of scientific articles represent studies on solar activity effects, lunar radio emission, and astronomical models. G.G.

N69-19531# Joint Publication Research Service, Washington, D. C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space No. 198 13 Feb. 1969 p 44–55 refs (See N69-19526 08-34)
Avail: CFSTI

The following topics are discussed: (1) launching of Venera-6 Venus probe; (2) stereographic device for computation of satellite ephemeris; (3) helium cooling for superconducting systems during space flight; (4) geological morphological mapping of the moon; and (5) development of a device for automatic prediction of satellite passages. Attached abstracts describes measurements of solar bursts, lunar emission, radiation effects, terrestrial and galactic radiation, etc. G.G.

N69-19546# Universidade do Porto, Oporto (Portugal). Observatorio Astronomico.
RESULTS OF OBSERVATIONS OF LATITUDE AT MONTE da VIRGEM
M. Barros, J. Osorio, and R. A. Vieira 1968 32 p ref *Its* No. 22
Avail: CFSTI

During the observation program the instrumental constants were checked. The mean values of one division of the levels were found by comparison with the micrometer, while the mean value of a turn of the micrometer screw was derived from observations of six pairs of close stars. Using a transit instrument of 70 mm aperture and 92 cm focal length, nearly 2000 star pairs were observed by Talcott's method in 207 evenings. The constants used in reducing the latitude observations are given. The mean latitude of the Observatory was evaluated, along with a set of corrections to the mean declinations of the star pairs observed. Author

N69-19566# Universidad Mayor de San Andres, La Paz (Bolivia). Lab. de Fisica Cosmica.
REPORT ON THE TOTAL SOLAR ECLIPSE, NOVEMBER 12, 1966
[1968] 31 p refs Presented at the Eclipse Symp., Sao Paulo, Brazil, 1968
Avail: CFSTI

This report includes: a description of the meteorological prevailing conditions at different places along the eclipse totality path inside Bolivia, and other scientific and technical considerations that were analyzed and used in the selection of the observation sites; proposed programs of observations, type of instruments used and scientific and technical personnel involved in the expeditions; results obtained and type of cooperation provided to the expeditions by different Bolivian institutions. The Eclipse experiments conducted at different Bolivian sites, included sky brightness and color measurements, corona and chromosphere observations, ionospheric soundings at low and high frequencies and ozone density measurements. Author

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N69-18545# Paris Observatory, Meudon (France).
ARTIFICIAL SATELLITES: OBSERVATIONS MADE AT MEUDON (1/1964 ECHO AND VARIOUS)
Paul Muller 1968 131 p
(Publ-18) Avail: CFSTI

Data of 3960 positions obtained during 544 transits are presented. The transits are given in chronological order with the following data: universal time, azimuth, elevation angle, right ascension, declination, and the equatorial coordinates. ESRO

N69-18546# Engins Matra, Boulogne-sur-Seine (France).
THE MOUNTING OF A SCIENTIFIC EXPERIMENT IN A SOUNDING ROCKET PAYLOAD. [STRUCTURE ET INSTALLATION D'UNE EXPERIENCE SCIENTIFIQUE SUR UNE FUSEE-SONDE]
B. Marx 19 Mar. 1968 23 p In FRENCH Presented at the CNES Symp. on Space Technol., Bretigny, France, 12 Mar.–2 Apr. 1968
Avail: CFSTI

An account of the various activities which must be undertaken by rocket experimenters between the drawing board and installation stages is given. The history of the payload fired by the French Ionospheric Research Group in January 1967 is used as an illustration. ESRO

N69-18697*# Sandia Corp., Albuquerque, N. Mex. Planetary Quarantine Dept.
THE DETERMINATION OF QUANTITATIVE MICROBIAL SAMPLING REQUIREMENTS FOR APOLLO MODULE
A. L. Roark Jan. 1969 28 p refs Sponsored in part by AEC
(NASA Order R-09-019-040)
(NASA-CR-99766; SC-RR-69-23) Avail: CFSTI CSCL 22B

The present work deals with the problem of estimating the total number of microorganisms on the surface of an Apollo module based on samples taken from a relatively small percentage of the total area of the module. The problem of establishing ahead of the sampling time the number of samples which will be needed to obtain various accuracies is discussed. Both the cotton swab method new used and the vacuum probe method of sampling which is being considered for use are evaluated. Tabulated data are presented on total module surface area, maximum microbial loading, and number of square inches required for sampling different parts of the LM, CM, and SLA. K.W.

N69-18730*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPIN AXIS DIRECTION DETERMINATION FOR THE GALACTIC-JUPITER PROBE
V. R. Simas Mar. 1967 38 p refs
(NASA-TM-X-63450; X-523-67-122) Avail: CFSTI CSCL 22B

The antenna for the envisioned spin stabilized Galactic-Jupiter Probe is an 8 foot body fixed paraboloid which at the 2.3 GHz down link frequency transmits a 4° pencil beam toward the earth. The spacecraft spin axis which is concentric to the antenna beam must be processed periodically to enable the antenna to follow the earth as it travels in its orbit about the Sun. The spacecraft spin axis direction determination is a 2 wavelength single baseline radio interferometer with its two antennas mounted symmetrically with

respect to the spin axis. The system's acquisition beamwidth is 24°. Operating on a received 2.1 GHz beacon signal radiated by earth stations the system employs phase monopulse techniques to derive a sinusoidally varying voltage synchronous to the spin rate. The amplitude of this voltage is proportional to the angular boresight error. The phase denotes the direction of the error and supplies timing signals for activating the series of propulsion pulses necessary to precess the spin axis in the proper direction to correct the error. When the angular boresight error exceeds the prescribed threshold value of 1°, a programmed attitude correction sequence is initiated by command from earth. Author

N69-18731*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NASA METEOROLOGICAL AND COMMUNICATIONS SATELLITE PROGRAMS
Herbert I. Butler Feb. 1969 39 p Presented at Natl. Council for Social Studies, Greenbelt, Md., 26 Nov. 1968
(NASA-TM-X-63481; X-482-69-16) Avail: CFSTI CSCL 22

A review of the meteorological and communications satellite programs is presented. The three major spacecraft projects in their support are: Tiros operational satellite, Nimbus, and Applications Technology Satellites. A brief description of each is given. Pictures of global cloud coverage are shown, and their use in weather forecasting is discussed. Possible use of the ATS in direct broadcasts, as educational television systems, is considered. F.O.S.

N69-18737# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, AUGUST 1968
10 Oct. 1968 28 p
(ROE-STS-80) Avail: CFSTI

Stopwatch observations made at stations connected with the Section during the months of 1968 August are listed in satellite launch order and in time order for each satellite. Various sub-totals are given. Author (ESRO)

N69-18748*# TRW Systems Group, Redondo Beach, Calif.
STUDY AND ANALYSIS OF SATELLITE POWER SYSTEMS CONFIGURATIONS FOR MAXIMUM UTILIZATION OF POWER, PHASE 2 Technical Report, 12 Sep. 1966–31 Dec. 1968
31 Dec. 1968 139 p refs (Contract NAS5-9178)
(NASA-CR-100038; TRW-04898-H001-R0-00) Avail: CFSTI CSCL 22B

The computer program for evaluating electric power system designs, as developed in Phase 1 of the study, was fully implemented on the IBM 7094 computer. Results of the implementation for EPSOM (Electric Power System Optimization Method) were within the expected ± 1% tolerance for system efficiency. The computerization also resulted in a configuration syntheses subroutine which has proved applicable to the existing design and promises to contribute to design development of new systems and their optimization. The need to improve the reliability of satellite power systems also led in Phase I to a design for Self Regulating and Protecting (SRAP) power systems, for which the present phase of the study provided a broad spectrum of failure modes analyses. These began at the component level and progressed through the circuit and equipment levels to the power system. All detection methods studied required a significant reaction time, in order to identify a potential failure and to take positive corrective action to prevent it from occurring. It was concluded that some form of time delay protection is necessary in order to apply the SRAP concept to power systems, and further investigation of these devices was recommended. A.C.R.

N69-18754*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ENGINEERING GUIDELINES FOR CLEAN ASSEMBLY AND STERILIZATION OF SPACEFLIGHT HARDWARE
Anne-Marie Crawford, and Edward Rich Nov. 1967 30 p refs
NASA-TM-X-63451; X-624-67-578) Avail: CFSTI CSCL 22B

Methods of clean assembly and sterilization of space flight hardware are discussed in view of international and national agreement to treat the planets as biological preserves, i.e., to prevent their contamination by viable earth organisms. Standards have been established by NASA to insure that the probability of a landing spacecraft carrying a single bacterium to contaminate a planet is no greater than 1×10^{-3}. For this purpose, the spacecraft must be assembled in laminar flow Class 100 clean rooms; the assembly must undergo frequent microbiological assays and approved sterilization cycles; and the sterilized assembly will be packaged in either a flexible or rigid bacteriological barrier bio-cannister. The container may not be opened until the spacecraft has left the earth's atmosphere. The methods used, and equipment and physical facilities available are discussed in detail. The compatibility of space flight materials with the two major established methods, dry heat and ethylene oxide, is also evaluated. A.C.R.

N69-18759*# Techtran Corp., Glen Burnie, Md.
AUTOMATIC ASSEMBLY IN SPACE [AVTOMATICHESKAYA SBORKA V KOSMOSE]
V. P. Legostayev et al Washington NASA Feb. 1969 26 p Transl. into ENGLISH from Russian Presented at the 19th Congr. of the Intern. Astronaut. Federation, New York, Dec. 1968
(Contract NASw-1695)
(NASA-TT-F-12113) Avail: CFSTI CSCL 22A

An analysis of the procedure of rendezvous and docking used in the Cosmos 186 and 188 and the Cosmos 212 and 213 satellites is presented. Rendezvous and docking is arbitrarily divided into four stages: Placement of satellites into near earth orbit, automatic rendezvous to 300–400 meters separation, automatic final approach, and docking itself. The control systems used are described in detail, and the equations of movement for the active and passive satellites are presented. The docking of the Cosmos 186 and 188 satellites is described. Author

N69-18770*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FORMULAS FOR LONG PERIOD RADIATION PRESSURE, LUNAR AND SOLAR GRAVITATIONAL EFFECTS ON THE MOTION OF ARTIFICIAL SATELLITES
David Fisher Feb. 1969 26 p refs
(NASA-TM-X-63455; X-550-69-36) Avail: CFSTI CSCL 22A

Long period formulations are given for satellites in which the perturbations due to solar radiation pressure and lunar and solar gravitational forces are of first order in magnitude. This occurs for the classes of scientific satellites whose ratio of reflecting surface to mass are .07 cm^2 per gram or larger, and for satellites whose semi-major axes are between 12,000 and 55,000 kilometers such as communications satellites and satellites having eccentricities as high as 0.85. The method of canonical transformations is applied to obtain analytic formulations which may be added to existing long period perturbation formulas given by Brouwer or Kozai for the earth's oblateness. A useful application of these results would be to incorporate them into existing programs to improve the accuracy of orbit determination. Author

N69-18784# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, SEPTEMBER 1968

24 Oct. 1968 15 p
(ROE-STS-81) Avail: CFSTI

Stopwatch observations made at stations connected with the Section during the months of 1968 September are listed in satellite launch order and in time order for each satellite. Various sub-totals are given. Author (ESRO)

N69-18785# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, OCTOBER 1968
25 Nov. 1968 20 p
(ROE-STS-82) Avail: CFSTI

Stopwatch observations made at stations connected with the Section during the months of 1968 October are listed in satellite launch order and in time order for each satellite. Various sub-totals are given. Author (ESRO)

N69-18796# Centre National d'Etudes Spatiales, Bretigny-sur-Orge (France).
GRAVITY GRADIENT STABILIZATION AND MAGNETIC HYSTERESIS DAMPING: THE SIZE OF THE DAMPING DEVICE [STABILISATION PAR GRADIENT DE GRAVITE ET AMORTISSEMENT PAR HYSTERESIS MAGNETIQUE: DIMENSIONNEMENT DU SYSTEME AMORTISSEUR]
P. Huguier 5 Apr. 1968 48 p In FRENCH Presented at the CNES Intern. Colloq. on Satellite Attitude and Stabilization, Brétigny, France, 8–11 Oct. 1968
Avail: CFSTI

The couples on a gravity gradient satellite are evaluated for two axis and three axis stabilization. Damping devices are discussed and the size of a magnetic hysteresis damping system is computed and optimized. A mathematical model is also presented. It is concluded that the performance prediction of such a device can only be approximate and that more research work is needed. ESRO

N69-18814# Nord Aviation, Chatillon-Sous-Bagneux (France).
DECELERATION BY MEANS OF A MAGNETIC FIELD OF INERTIAL WHEELS ONBOARD A SATELLITE ORBITING ON AN EQUATORIAL OR A QUASI-EQUATORIAL ORBIT [DESATURATION MAGNETIQUE DES VOLANTS D'INERTIE D'UN SATELLITE EN ORBITE EQUATORIALE OU FAIBLEMENT INCLINEE]
L. Laury 1968 29 p In FRENCH Presented at the 8th European Space Symp., Venice, 27–29 May 1968
(SSA-33-68) Avail: CFSTI

A satellite stabilized by means of three inertia fly-wheels with acceleration of the flywheels being performed onboard by a local magnetic field is considered. The operating mode of such a system in the case of an equatorial orbit is discussed and applied to a satellite launched from Kourou (French Guiana) 5e north. ESRO

N69-18823# Bolkow Entwicklungen K.G. Munich (West Germany). Future Projects Dept.
PAYLOAD SHROUDS FOR EUROPEAN FUTURE GENERATION LAUNCHERS
Sep. 1968 70 p refs
(Contract ELDO-CTR-17/4/8)
(Bolkow-DSF-6.423.0) Avail: CFSTI

Design characteristics of satellites for the future generation of European launchers are outlined. Special attention is given to the transmission system for direct television broadcasting and to the design of satellite fairings for the payloads considered. ESRO

N69-18830# Paris Observatory, Meudon (France).
ARTIFICIAL SATELLITES: OBSERVATIONS MADE AT MEUDON (III/1964 ECHO AND VARIOUS) [SATELLITES ARTIFICIELS: OBSERVATIONS FAITES A MEUDON (II/1964 ECHO ET DIVERS)]
Paul Muller 1968 141 p In FRENCH; ENGLISH summary
Sponsored by the CNES
(Publ-19) Avail: CFSTI

Data of 4269 positions obtained during 616 transits are presented. The transits are given in chronological order with the following data: universal time, azimuth, elevation angle, right ascension, declination, and the equatorial coordinates. ESRO

N69-18844# Paris Observatory, Meudon (France).
ARTIFICIAL SATELLITES: OBSERVATIONS MADE AT BESANCON (2/1963 ECHO 1) [SATELLITES ARTIFICIELS: OBSERVATIONS FAITES AT BESANCON (2/1963 ECHO 1)]
Paul Muller 1967 97 p
Avail: CFSTI

The observations include 4171 points obtained during 111 transits. The transits are given in chronological order with the following data: universal time, azimuth, elevation angle, right ascension, declination, and the equatorial coordinates. ESRO

N69-19034*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
THE CONCEPTUAL DESIGN OF A SMALL SOLAR PROBE (SUNBLAZER)
Richard H. Baker ed. and Daniel H. Galvin, Jr., ed. Jan. 1969 524 p refs
(Contract NASr-249)
(NASA-CR-100034; MIT-CSR-TR-69-1) Avail: CFSTI CSCL 10B

A scientific experiment to measure the electron density of the solar corona using apparatus consisting of a small, solar-pressure-oriented spacecraft containing a multiple-frequency, pulsed, 2-kilowatt, solid-state transmitter, and a terrestrial 50-dB dipole phased array receiving antenna is described. Included are analyses of the communication system, the 0.63-AU perihelion solar orbit, the semi-passive attitude control system, the spacecraft power and thermal control systems. The conceptual electrical and mechanical design of the spacecraft hardware covers the basic configuration, RF and digital electronics design and packaging; and includes fundamental stabilization, separation, despin and deployment schemes. Author

N69-19066*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESULTS OF SEVERAL EXPERIMENTAL INVESTIGATIONS OF THE STATIC AERODYNAMIC CHARACTERISTICS FOR THE APOLLO/SATURN 5 LAUNCH VEHICLE
Clyde E. Walker 21 Aug. 1968 190 p refs
(NASA-TM-X-53770) Avail: CFSTI CSCL 22D

Experimental static aerodynamic data for six configurations of the Apollo/Saturn V launch vehicle are presented. Tests were conducted at six different facilities on 0.3366, 0.9, and 4 percent scale models at Mach numbers ranging from 0.5 through 7.81, at angles of attack ranging from −4 through +20 degrees, and for Reynolds numbers ranging from 0.5×10^6 through 8.0×10^6 based on vehicle reference diameter. All configurations were tested at a roll angle of zero degrees, and some were also tested at +45 and +90 degrees roll angle. Correlation of data from the different tests was reasonably good except where the force balance was not properly matched to the configuration and, in one case, where protuberance effects were not correctly simulated with the smallest model. Author

N69-19089# Joint Publications Research Service, Washington, D. C.
CATASTROPHE IN THE APOLLO SPACESHIP CABIN AND MEASURES FOR INCREASING PREVENTION OF FIRES AND EXPLOSIONS DURING SPACE FLIGHTS
I. M. Abduragimov et al *In its* Space Biol. and Med., Vol. 2, No. 6 5 Mar. 1969 p 1–8 refs (See N69-19088 08-04)
Avail: CFSTI

A brief analysis of the Apollo I spaceship cabin fire is given and possible causes of the catastrophe are depicted. Although the direct and precise reasons for the occurrence of the fire are not determined it is believed that the source of the conflagration was an overheated conductor or an electrical spark. Contributing factors were also: (1) the oxygen atmosphere in the cabin at a pressure exceeding the normal operating pressure; (2) fuel materials in the cabin; (3) insufficient reliable fluid circulation lines and insulation of current carrying leads; and (4) a nitrogen–oxygen mixture would have reduced the fire danger. Also recommended are the use of spun glass fibers instead of synthetic materials and silicone materials in place of polyurethane. G.G.

N69-19165*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
TITAN/MARS HARD LANDER, VOLUME 1: 1400 LB CAPSULE SYSTEM DESIGN STUDY
6 Jan. 1969 539 p refs
(Contract NAS1-8098)
(NASA-CR-66727-1; Doc-68SD7041-Vol-1) Avail: CFSTI CSCL 22B

This 1400-lb flight capsule, in conjunction with a relay support module, is to be transferred to the planet Mars in 1973 on a flyby trajectory by a Titan IIIC launch vehicle. The baseline support module used in the study is a minimum Mariner '69 configuration weighing 659 lb. The flight capsule is designed for a direct entry mission based on a nominal path angle of 21° and worst case cumulative environments for the entry aeroshell and landing conditions. A radar altimeter is used to deploy the parachute. The lander is designed for impact at 100 fps in the surface environments. Component packaging studies were performed together with hardened component studies to provide the design rationale for an integrated lander package. The additional support module requirements for the Mariner '69 minimum orbiting relay are described (1157 lb). Launch vehicle and spacecraft adapter design studies are summarized which show that slightly more than 200 lb of adapter structure is required to provide simple attachment to the Titan IIIC transtage. The design study constraints and the mission are defined, with consideration of the entry and retardation worst case design rationale and the design rationale for landed surface operations. The entire spacecraft system is described, including the detailed subsystem background. K.W.

N69-19166*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
TITAN/MARS HARD LANDER, VOLUME 2: AUTONOMOUS CAPSULE SYSTEM DESIGN STUDY
6 Jan. 1969 161 p refs
(Contract NAS1-8098)
(NASA-CR-66727-2; Doc-68SD7041-Vol-2) Avail: CFSTI CSCL 22B

A feasibility study was conducted to determine the suitability of autonomous hard lander capsules for Mars '73 missions. The autonomous capsule is essentially a self-contained landing system. An autonomous reference mission was formulated within the capability of a Titan IIIC booster, with optimized direct earth communication. The mission is analyzed, and hardware is identified to enable the capsule to perform all functions from booster separation to the end of the surface mission. Possible spacecraft configurations and the stabilization mode for the cruise phase are evaluated. Weight statements are presented afor the autonomous capsule and for a direct entry lander with deflected relay support module. It is concluded that the approach examined in this study is not the optimum way to fulfill early Mars exploration objectives. K.W.

N69-19380# National Research Council of Canada, Ottawa (Ontario). Space Research Facilities Branch.
BLACK BRANT ROCKET ADD-VB-18 LAUNCHED AT CHURCHILL RESEARCH RANGE, 2 AUGUST 1968
Dec. 1968 30 p refs *Its* Operations Requirement No. 343 (SRFB-018) Avail: CFSTI

The engineering aspects of preparing the payload and the launching of Black Brant rocket ADD-VB-18 at Churchill Research Range at magnetic midnight on 2 August 1968 are treated. The payload included experiments to measure electric fields, currents and magnetic field variations, electron density and temperature, plasma potential, electron flux, flux and spectrum of incoming electrons in the energy range 30 ev to 10 Kev. In addition two canisters containing barium seeding were to be released, and electric field measurements conducted. Author

N69-19430*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GUIDANCE AND CONTROL DIVISION
In its Space Programs Sum. No. 37-54, Vol. 3, Oct.–Nov. 1968 31 Dec. 1968 p 40–82 refs (See N69-19427 08-34)
Avail: CFSTI CSCL 22B

Results of continuing research in several areas of spacecraft guidance and control systems are reported. The derivation of a pathfinding algorithm for navigating a computer guided automatic roving vehicle is described. In the area of spacecraft power, summaries are included on the effect of electrolyte concentration of the electrical characteristics of AgO–Zn battery cells; the results of thermoelectric generator testing; the development of a power conditioner for a thermionic diode array; the performance of the AgO–Zn heat sterilizable battery; and the use of an integrated heat pipe/tubular thermoelectric module as an energy conversion system for spacecraft. Support equipment for a strapdown electrostatic aerospace navigator is described. Developments in spacecraft control systems, including an actuator for a clustered ion engine array; sterilizable inertial sensors; and ion engine thrust phase attitude control systems using flexible solar arrays are summarized. Guidance and control research included testing of the pre-ignition characteristics of cesium thermionic diodes, and investigation of barrier heights of blocking contacts to vacuum cleaved photoconducting CdS in the conducting state. A.G.R.

N69-19497# Institut d'Aeronomie Spatiale de Belgique, Brussels.
THE MAGNETOHYDRODYNAMICAL DRAG ON ARTIFICIAL SATELLITES
E. Aerts 1969 22 p refs *Its* Aeronomica Acta No. 58, 1969
Avail: CFSTI

It is shown that no actual artificial terrestrial satellite is able to generate magnetohydrodynamical waves by its own movement. Assuming that the observed induction drag is due to perturbations of a steady state, a quasi-hydrodynamic approximation of the problem is made. The theory gives results of the right order of magnitude for the phenomenon, given some acceptable assumptions. Author

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N69-18328 Florida Univ., Gainesville.
DYNAMIC BEHAVIOR OF HEATED CYLINDRICAL AND CONICAL SHELLS
Chung-li Sun (Ph.D. Thesis) 1967 105 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-9570

The present analysis is to study the elastic, dynamic stability and response of conical and cylindrical shells subjected to time-dependent heating. Two phases of the problem were treated. First, a linear shallow shell theory was used. The shells become dynamically unstable when the normal displacement component due to thermal stresses increases unboundedly with time. Second, a nonlinear shallow shell theory has been adopted. The post-buckling amplitude-frequency relationship shows that the solution originating at the upper boundary of the instability region is always unstable, while the solution originating at the lower boundary of the instability region is always stable. Two kinds of temperature change with respect to time were considered. In one case, the temperature change is sinusoidal, and in the other case, the temperature function is a ramp-type. The shells are simply supported and completely restricted at both ends. Dissert. Abstr.

N69-18427 Pennsylvania Univ., Philadelphia.
MACROSCOPIC BEHAVIOR OF HETEROGENEOUS HEREDITARY MEDIA
Kalman Mayer Schulgasser (Ph.D. Thesis) 1967 132 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-9234

It is shown that rigorous bounds can be found on the macroscopic behavior of heterogeneous hereditary media which are statistically homogeneous and isotropic. Specifically, by describing hereditary media in terms of their response to sinusoidally time varying fields, bounds are found on the in-phase and out-of-phase responses. That is, bounds are found on the real and imaginary parts of the effective complex constant(s) that serves to describe the composite medium at any frequency. For dielectrics the Hashin–Shtrikman variational principles are extended to include complex material constants, and upper and lower bounds are found on effective dielectric constant and loss factor. For two phase media it is shown that the lower founds on both the dielectric constant and loss factor are the best possible knowing only volume fraction of the constituents and the properties of the constituents. Additionally, it can sometimes be shown that one, but not both, of the upper bounds is the best possible. Dissert. Abstr.

N69-18428 Tennessee Univ., Knoxville.
A THEORETICAL AND EXPERIMENTAL ANALYSIS OF BUCKLING OF SPHERICAL DEEP SHELLS UNDER CONCENTRATED LOAD
Danny Lawrence Reed (Ph.D. Thesis) 1967 206 p
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 68-9825

The buckling of a number of thin, deep spherical shells with fixed edge supports was experimentally investigated. The concentrated loads were applied at the apex of the shell. It was also the purpose to obtain a theoretical solution in the form of load deflection curves using an energy method of approach. Spherical shells with a radius and thickness of approximately 6.340 and 0.020 inches, respectively, were used for the experimental investigations. Several different shell configurations were tested. They ranged in depth from shallow to very deep shells. The concentrated buckling loads were applied with both a dead weighting system and a constant displacement type of loading system. One of the shells was strain gaged in order to determine stress distributions as the concentrated load was being applied. The results of the test were shown in plots of a load parameter versus the ratio of apex deflection and shell thickness. Dissert. Abstr.

N69-18430 Florida Univ., Gainesville.
ON SOME GEOMETRICAL NONLINEAR THEORIES FOR THE PLASTIC BENDING, STRETCHING AND BUCKLING OF SANDWICH PLATES
Fred Jacob Monzel (Ph.D. Thesis) 1967 218 p
Avail: Univ. Microfilms: HC $9.90/Microfilm $3.00 Order No. 68-9481

On the basis of the modified Hellinger–Reissner variational theorem of nonlinear elasticity, a general nonlinear theory is developed for sandwich plates that are stressed in the plastic region. The plasticity equations correspond to the stress–strain equations of Hencky, extended to large deformations. As a result, the material is taken to be isotropic, and the loading is assumed to be both proportional and active. The general theory is then extended to the buckling of sandwich plates by applying the bifurcation theory. In addition, by omitting certain quadratic terms from Green's strain tensor, a simplified large deflection theory is developed for the plastic bending, stretching and buckling of sandwich plates. Furthermore, the theory is then extended to those sandwich plates which have thin outer layers; in this case, the Kirchhoff–Love hypothesis is applied. Finally, a numerical solution is obtained for the plastic buckling of a simply supported sandwich plate with very thin outer layers and a soft core under a uniaxial compressive load. Dissert. Abstr.

N69-18438 Cornell Univ., Ithaca, N. Y.
YIELD POINT LOAD OF A CONICAL SHELL
Chen-hsiung Lee (Ph.D. Thesis) 1968 91 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-9888

A simply supported conical shell loaded at its vertex through a central boss is considered. The shell material is rigid perfectly plastic and is assumed to obey Tresca's yield condition. The complete solutions for exact and simplified yield conditions are constructed by numerical methods. The proper choice of yield condition is predicted by a natural extension of the stress profile on the yield surface and checked locally by the flow rule, and overall by boundary conditions. The simplified yield condition in geometric language is one which partly coincides and/or partly circumscribes the exact yield surface. Such simplification is made only in the region of the shell where circumferential membrane force n_φ becomes large. The problem is also studied from the point of view of limit analysis and treated as an optimal control problem. A steepest-ascent programming method to find the maximum lower bound for the collapse load for a problem of this nature is formulated. The application of the method to the conical shell problem is summarized. Dissert. Abstr.

N69-18466 Delaware Univ., Newark.
LARGE AMPLITUDE OSCILLATIONS OF THICK AND THICK-WALLED ELASTIC INCOMPRESSIBLE BODIES
Show Dwo Wang (Ph.D. Thesis) 1967 285 p
Avail: Univ. Microfilms: HC $11.50/Microfilm $3.30 Order No. 68-9814

A general theory of three dimensional elasticity based on a semi-inverse method is formulated using a convective coordinate

system. This theory, used in the past for solving classes of static problems, is modified to include the dynamic phenomena. Among these phenomena are simple shear oscillations of infinite slabs and prismatic bodies, pure radical oscillations of circular tubes, pure radial oscillations of spherical shells, telescopic and radial-telescopic oscillations of circular cylinders and cylindrical tubes and flexural oscillations of rectangular blocks. In each case, nonlinear partial differential equations are obtained governing the problem. Some of these equations could be solved explicitly using an arbitrary strain-energy function of the material. If this could not be achieved, either the strain-energy function was assumed in a specific form or the governing equation was treated by an approximate technique. For each class of oscillations, illustrative examples were worked out in detail using known forms of the strain-energy functions. Dissert. Abstr.

N69-18496# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BALANCING OF MACHINES AND INSTRUMENTS (SELECTED ARTICLES)
8 Jan. 1968 44 p refs Transl. into ENGLISH of the book "Uravnoveshivaniye Mashin i Priborov" Moscow, Izd-Vo Mashinostr., 1965 p 17–45, 255–257 refs
(AD-679733; FTD-HT-23-771-67) Avail: CFSTI CSCL 20/11

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2. BALANCING OF ROTORS IN PRECISION INSTRUMENT MANUFACTURE. SOME PROBLEMS IN BALANCING ROTORS OF GYROSCOPE DEVICES K. S. Terekhova p 31–33 refs (See N69-18498 08-32)

N69-18497# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON SYNTHESIZING OSCILLATING SYSTEMS OF BALANCING DEVICES
G. N. Petrov *In its* Balancing of Machines and Instr. 8 Jan. 1968 p 1–30 refs (See N69-18496 08-32)
Avail: CFSTI

The methodology of synthesis of vibrating systems for balancing equipment is theoretically investigated. Since the problems of proper instrumentation and isolation of the balancing equipment from foundation disturbances are discussed elsewhere, this paper is concerned primarily with the synthesis of the mechanical vibrating systems of balancing machinery and their effective use. Author

N69-18498# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BALANCING OF ROTORS IN PRECISION INSTRUMENT MANUFACTURE: SOME PROBLEMS IN BALANCING OF ROTORS OF GYROSCOPE DEVICES
K. S. Terekhova *In its* Balancing of Machines and Instr. 8 Jan. 1968 p 31–33 refs (See N69-18496 08-32)
Avail: CFSTI

The accuracy of modern precision- and floating-type gyroscopes used in inertial guidance systems is high. A further increase in gyroscope accuracy can be accomplished in two ways: by improving gyroscope manufacture and design, and by developing better gyroscopes, based on new operating principles. The article describes some problems connected with increasing the accuracy of the balancing of gyrorotors, and a number of difficulties encountered in this process. The main problem is the balancing of the small synchronous gyromotors with miniature bearings, in which, in addition to the usual vibrations caused by bearings, there exist vibrations due to magnetic forces. The balancing of the rotor in such cases can be accomplished only during run-out when the power supply is cut off. The accuracy of such balancing is limited by vibration due to the magnetic force, caused by the asymmetrical position of the rotor in the stator magnetic field. To increase the accuracy of balancing the synchronous rotors in small gyromotors, a special intermittent three-phase power supply is proposed, from which the vibration caused by the magnetic field can be filtered out. Author

N69-18511# National Physical Lab., Teddington (England). Div. of Numerical and Applied Mathematics.
STRESSES IN AND AROUND ELLIPTIC ELASTIC INCLUSIONS
G. T. Symm Oct. 1968 25 p refs
(NPL-MA-69) Avail: CFSTI

It has been shown by Hardiman that constant stresses at infinity in an elastic plate containing an elliptic inclusion of different material induce constant stresses in the inclusion. The purpose of the present investigation is to derive expressions for the stresses at points both inside and outside the inclusion from complex potentials given by Hardiman, and to compute the stresses in a wide variety of cases. Numerical results are presented in the form of data sheets. Author (ESRO)

N69-18535 Catholic Univ. of America, Washington, D. C.
CREEPING-WAVE ANALYSIS OF ACOUSTIC SCATTERING BY ELASTIC, CYLINDRICAL SHELLS
Peter Uginchius (Ph.D. Thesis) 1968 112 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-9258

The Sommerfeld–Watson transformation is applied on the normal-mode solution of a plane wave being scattered by an infinite, elastic, cylindrical shell immersed in a fluid and containing another fluid. The resulting residue series is generated by poles which are the complex zeroes of a six-by-six determinant. These zeroes are found numerically by an extension of the Newton–Raphson method for complex functions. It is found that besides the infinity of the well-known rigid zeroes there exists a set of additional zeroes, which gives rise to generalized Rayleigh and Stoneley waves. Numerical results include scattering cross sections, phase velocities, group velocities, critical angles and attenuation factors for the dominant creeping-wave modes. Dissert. Abstr.

N69-18569 Iowa Univ., Iowa City.
OPTIMUM FREQUENCY DESIGN OF STRUCTURAL ELEMENTS
Melville Richard Johnson (Ph.D. Thesis) 1968 82 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-10664

The distribution of mass that will give a maximum value to the first fundamental frequency of structural elements was investigated. The total amount of mass in the structure is constrained to be constant. A gradient technique is employed to locate the optimum. The structural elements are considered to be perfectly elastic and dissipation forces are not considered. For such a system a unique force-displacement relationship can be found and by using a lumped mass analysis an n dimensional eigenvalue problem can be defined with the frequencies as the eigenvalues. By introducing a general mass-stiffness relationship the eigenvalue problem defines an n dimensional response surface in the n+1 dimensional space consisting of the n mass values and the fundamental frequency. This surface is constrained such that the sum of the mass values is equal to the total mass of the system. A first order gradient method is used to determine the optimum mass distribution and corresponding fundamental frequency. Dissert. Abstr.

N69-18738*# Alabama Univ., University. Bureau of Engineering Research.
EXPERIMENTAL INVESTIGATION OF THE IMPACT CHARACTERISTICS OF NON-METALLIC MATERIALS Final Report
James L. Hill and David W. Cormany 30 Sep. 1968 80 p refs
(Contract NAS8-20346)
(NASA-CR-98292) Avail: CFSTI

Impact tests were performed on solid, vesicular, and granular samples of volcanic pumice and basalt. Characteristic craters were produced for each type of solid sample, and for definite sized ranges of granular material. The craters in solid basalt are shallow and wide, this due to large spalls being sheared from the craters. The craters in vesicular basalt are produced by direct crushing and by the intense pressure wave generated by impact. These are more conical in profile. The craters in pumice vary greatly with changes in density of the target material. The crater shapes vary from a long, narrow burrow, produced almost entirely by direct crushing action to an impact-shear type crater very similar to these in vesicular basalt with increasing sample density. Empirical quantitative relations were obtained relating certain crater parameters to impact energy and material crushability. Author

N69-18817 Cornell Univ., Ithaca, N. Y.
NONLINEAR FLEXURAL VIBRATION OF CLAMPED CIRCULAR PLATES
George Chai-Schih Kung (Ph.D. Thesis) 1968 105 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-9887

Large amplitude flexural vibration of clamped circular plates is studied both theoretically and experimentally. The equations of motion in polar coordinates are derived from the three dimensional theory of elasticity, which may be considered the dynamic analog of von Karmen's plate equations. The equations are then reduced to an ordinary differential equation by using Galerkin method. The reduced ordinary differential equation is the well known Duffing's equation and is solved approximately. The theoretical calculation indicates a non-linearity of the hardening type for clamped circular plates. For the free vibration, the period of vibration decreases with increasing amplitude. When the amplitude of vibration is twice the plate thickness, the corresponding period is 65% of that corresponding to linear vibration. For the forced vibration, the familiar jump phenomenon takes place. Dissert. Abstr.

N69-18819# Centre National d'Etudes Spatiales, Paris (France).
REPORT ON QUALIFICATION TESTS OF STRUCTURES [SPECIMEN DE COMPTE-RENDU D'ESSAI DE QUALIFICATION DE STRUCTURE]
V. Hantcherian [1968] 41 p In FRENCH Presented at the CNES Symp. on Space Technol., Bretigny, France, 12 Mar.–2 Apr. 1968
Avail: CFSTI

The model of a structural test report is presented to students in aerospace engineering. ESRO

N69-18895*# General Dynamics/Convair, San Diego, Calif.
EVALUATION OF THE RADIOGRAPHIC THRESHOLD DETECTION LEVEL OF SUBSURFACE CRACK-LIKE DEFECTS IN ALUMINUM WELDS
R. W. Tryon Sep. 1968 59 p refs
(Contract NAS8-20185)
(NASA-CR-98355; GDC-ZZ-68-010) Avail: CFSTI CSCL 20K

A test program was conducted to design and fabricate special graduated aluminum penetrameters to evaluate the threshold detection capabilities of a fixed radiographic technique in detecting surface and subsurface cracks in one-quarter inch 2014-T651 aluminum welds. Tapered slits of predetermined dimensions were selected to simulate aligned weld cracks by bonding the penetrameters to the centerline of the weld of a matched set of weld test plates. Various penetrameter thicknesses were used to simulate crack depth. Equally thin hole-type penetrameters containing eight holes with varying diameters were also prepared to determine the smallest hole image resolvable under the fixed radiographic technique. Test variables evaluated included hole and slit depths, the location of the penetrameter within the test plates, and X-ray beam angles of 0, 5, 10, 15, and 20 degrees. A total of 80 radiographs were taken. The radiographic films were evaluated and the threshold detection capabilities of the fixed radiographic technique were defined and compared in terms based on relationships between minimum detectable width, depth, and length of the slits and the maximum radiographic sensitivities achieved for the graduated hole penetrameters. Author

N69-18899 Pennsylvania State Univ., University Park.
MULTIPLE STRESS WAVE DISCONTINUITIES IN FINITE BEAMS AND PLATES
Herbert Abraham Koeing (Ph.D. Thesis) 1967 139 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-8712

A certain type of direct analysis is employed to solve for the dynamic variables in problems of traveling fluxural waves in finite beams and plates, for which shear correction and rotatory inertia are considered. The method of analysis is extended in order to properly treat the coupling of the two waves (dilation and shear) which are generated as a result of an arbitrary loading. Finite beams and plates are considered so that the effect of reflections on the magnitude of the variables is determined. The effect of the length of the bounded medium (beam or plate) on the values of the stresses is discussed. The proper boundary conditions for these problems are discussed. The resonant characteristics of a Timoshenko cantilever beam are studied and provide an independent check on the accuracy of the solutions. Results for moment, velocity, and shear inputs are presented showing discontinuities traveling at both wave speeds. In addition, the effect of the slower discontinuity on the stresses is studied by observing its reflective properties. Dissert. Abstr.

N69-18936 Pennsylvania State Univ., University Park.
FAILURE CRITERIA FOR VISCOELASTIC MATERIALS UNDER BIAXIAL STRESS FIELDS
Chun Kil Lim (Ph.D. Thesis) 1967 173 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-8720

The purpose of this investigation is to develop failure criteria for viscoelastic materials under biaxial stress fields from a prior knowledge of failure behavior in the simple state of stress, namely, the uniaxial loading. Specifically, the failure criteria studied are: (a) the energetic criterion for viscoelastic materials containing crack-like flaws under biaxial stress fields and (b) the critical stress criterion for viscoelastic materials containing circular flaws under biaxial stress fields. Experimental verifications of the failure criteria developed are made for several high polymers, namely, filled Hycar, Paracril, and Solithane. The experiments were conducted by subjecting cylindrical tubular specimens to linearly increasing biaxial loads with respect to time. The conclusion follows that the degree of compressibility of viscoelastic materials changes with the rate of loading. Dissert. Abstr.

N69-18955 Florida Univ. Gainesville.
BUCKLING AND DEFORMATION OF HEATED CONICAL SHELLS
Lu-Kang Chang (Ph.D. Thesis) 1967 160 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-9494

The instability of truncated conical shells due to thermal loadings was studied. The basic governing equations were derived by use of the large deflection theory, and Galerkin's method was employed to integrate the equilibrium equation. Two cases were considered. In one case, the temperature varies along the generator, and the conical shell is restricted completely at both ends; while in the other case, the temperature changes in two principal directions, and the cone is constrained along the perimeter but is free of resultant longitudinal force at boundaries. The edges are simply supported. The relation of the critical temperature to the geometric parameters were evaluated. Three parameters were used: the radius-thickness ratio, the radius-height ratio, and the cone's vertex angle. The radius-thickness ratio has the most significant effect on the value of critical temperature. A higher buckling temperature was found by nonlinear analysis when compared to that obtained by linear analysis. Dissert. Abstr.

N69-19009 Pennsylvania State Univ., University Park.
VIBRATION AND WAVE PROPAGATION IN CYLINDRICAL SHELLS
Edward Morris Frymoyer (Ph.D. Thesis) 1967 224 p
Avail: Univ. Microfilms: HC $10.15/Microfilm $3.00 Order No. 68-8690

The generalized approximate equations of motion of a cylindrical shell are developed. The long wavelength, low frequency approximation is shown to be the zero order or Flügge approximation. The characteristics of the mode dispersion spectrum are investigated as a function of frequency for the first few roots for orders zero to four, including real, imaginary and complex wave numbers. The dependence of the complex and imaginary branches on shell geometric factors of thickness and radius are presented. Comparison is made to three-dimensional elasticity analysis and to Mirsky–Herrmann theory. Zero order shell theory has excellent agreement in all details with the full three-dimensional elasticity analysis at low frequencies. The change from thin to thick shell behavior for the complex branch or end modes is traced. The radial displacement conditions for various end conditions of a thin cylindrical shell are given. Expressions are given for the various shell impedances. The input impedance for longitudinal point force input is calculated. Dissert. Abstr.

N69-19030*# Iowa Univ., Iowa City.
IMPROVEMENT OF AN INTEGRAL EQUATION METHOD IN PLANE ELASTICITY THROUGH MODIFICATION OF SOURCE DENSITY REPRESENTATION
Kwan Rim and Allen S. Henry Washington NASA Feb. 1969 47 p refs
(Contract NsG-576)
(NASA-CR-1273) Avail: CFSTI CSCL 20K

The research reported herein shows that greater accuracy in calculated boundary stress components can be obtained if the numerically-determined, piece-wise constant source density functions are replaced by functions which, with their first derivatives, are continuous on the boundary. In contrast to other reported results, this modification permits one to compute unknown boundary stress components directly from the approximate stress function without recourse to such indirect techniques as extrapolation, numerical differentiation, and others. As the result, a direct comparison between the specified boundary stresses and those boundary stresses consistent with the approximate biharmonic stress function is now made possible; and thereby the usefulness of the integral equation method in plane elasticity is considerably enhanced. Author

N69-19037# Aerospace Corp., San Bernardino, Calif.
SAAS 2: FINITE ELEMENT STRESS ANALYSIS OF AXISYMMETRIC SOLIDS WITH ORTHOTROPIC, TEMPERATURE-DEPENDENT MATERIAL PROPERTIES
Robert M. Jones and James G. Crose Sep. 1968 318 p refs
(Contract F04701-68-C-0200)
(AD-679983; SAMSO-TR-68-455; TR-0200(S4980)-1) Avail: CFSTI CSCL 20/11

The finite element method is used to determine the displacements, stresses, and strains in axisymmetric solids with orthotropic, temperature-dependent material properties under axisymmetric thermal and mechanical loads. The mechanical loads can be surface pressures, surface shears, and nodal point forces as well as an axial acceleration or angular velocity. The continuous solid is replaced by a system of ring elements with triangular or quadrilateral cross sections. Accordingly, the method is valid for solids which are composed of many different materials and which have complex geometry. A listing of the resulting FORTRAN IV computer program and instructions for its use are given in appendixes. Two-dimensional mesh generation and temperature interpolation features allow the computer program to be readily used. The convergence of the method to exact answers with diminishing element size is demonstrated and discussed. Author (TAB)

N69-19038# California Univ., Livermore. Lawrence Radiation Lab.
ACOUSTIC EMISSION: STRESS WAVE DETECTION AS A TOOL FOR NONDESTRUCTIVE TESTING AND MATERIAL EVALUATION
Robert B. Engle and Harold L. Dunegan 13 Sep. 1968 28 p refs Presented at the 8th Symp. on Phys. and Nondestructive Testing, Schiller Park, Ill., 24–26 Sep. 1968
(Contract W-7405-ENG-48)
(UCRL-71267; CONF-680931-1) Avail: CFSTI

Methods for nondestructive test and material evaluation using acoustic-emission signals are reported. Experimental results show that emission from flawed specimens is characteristically different from emission from flaw-free specimens. Experiment also shows that acoustic emission from flawed specimens is normalized by the stress intensity factor that is basic to the study of brittle fracture. These results suggest applications to nondestructive testing and material evaluation that are being investigated. Work with some of these applications is described; notably a proposed acceptance test and fatigue crack extension monitoring, in the area of NDT; and determination of a critical stress intensity factor for stress corrosion cracking, in the area of material evaluation. Data from tensile tests of 7075–T6 aluminum suggest a correlation between the acoustic-emission rate and an expression describing mobile dislocation density as a function of plastic strain. Further search is intended for correlations between acoustic-emission behavior and dynamic dislocation parameters. Some of these planned efforts are described. A theoretical base is expected to lead to further applications and clearer interpretation of present NDT results. Author (NSA)

N69-19041 Virginia Polytechnic Inst., Blacksburg.
PERTURBATION ANALYSIS OF SOME AXISYMMETRIC PROBLEMS IN PLATES AND SHELLS
James Ray Stafford, Jr. (Ph.D. Thesis) 1968 93 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-8997

The solutions to the shell problems are in a closed form for each of the first two approximations resulting from an expansion of the dependent variable in a power series in terms of a small perturbation parameter. In the plate problems, a systematic perturbation analysis is performed on Reissner's differential equations for finite deflections, and a numerical comparison is made between the von Karman boundary layer equations and the full Reissner boundary layer equations. For each of the plate problems two sets of boundary layer equations are developed for finite deformations by using the method of matched asymptotic expansions. One set of boundary layer equations represents the first deformations by using the method of matched asymptotic expansions. One set of

boundary layer equations represents the first approximation to the Reissner formulation for rotations of order one. The other set corresponds to the first approximation to the boundary layer equations of the von Karman theory. Dissert. Abstr.

N69-19058*# Benson (Robert W.) and Associates, Inc., Nashville, Tenn.
DEVELOPMENT OF NON-DESTRUCTIVE METHODS FOR DETERMINING RESIDUAL STRESS AND FATIGUE DAMAGE IN METALS Monthly Progress Report
30 Jun. 1967 13 p
(Contract NAS8-20208)
(NASA-CR-98349; MPR-24) Avail: CSCL 20K

Special emphasis was given to the practical application of the stress analysis techniques which have been developed. The techniques, which allow for the measurement of stresses in metallic samples both through the bulk of material and near the surfaces, have been developed sufficiently so that routine measurements can be made under laboratory conditions with satisfactory accuracy and good repeatability. The particular practical application under study is the measurement of stress in flat plates which have a butt weld joint. The strain gauge method is limited to measuring the net change in stress which occurs during welding. The ultrasonic methods allow for an absolute measurement of stress both before and after welding. The measurements which are being made on welded plates are described in detail, and other studies relating to the measurement of fatigue damage in metals are summarized. Author

N69-19122# Battelle Memorial Inst., Columbus, Ohio.
INVESTIGATION OF THE INITIATION AND EXTENT OF DUCTILE PIPE RUPTURE Quarterly Progress Report, Jul.–Sep. 1968
Robert J. Eiber, Willard A. Maxey, Arthur R. Duffy, and Thomas J. Atterbury 1 Nov. 1968 8 p
(Contract W-7405-ENG-92)
(BMI-1853) Avail: CFSTI

Pipe-rupture experiments are being conducted to define the sizes of defects for initiating fractures in PWR and BWR primary-coolant piping and to test analytical methods. The experiments are being conducted on 24- and 12.75-inch dia pipes of A 106B steel and Type 316 stainless steel. Of the analytical methods, the fracture-mechanics K_c approach is very sensitive to the plastic-zone correction term, while the flow-stress approach predicts critical through-wall and surface flow sizes from tensile-test results. Four full-scale experiments were completed, and the fracture results on the surface and penetration defects are discussed. NSA

N69-19146# Brown Engineering Co., Inc., Huntsville, Ala. Research Labs.
BUCKLING OF CIRCULAR CYLINDRICAL MULTISANDWICH SHELLS
S. D. Liaw Jan. 1969 41 p refs
(AST-286) Avail: Issuing Activity

A variational method is presented showing the development of the governing equations for bending and axial compressive elastic buckling of a circular cylindrical shell with multisandwich construction. The equations were eventually reduced to a single equation of Donnell's type defining the out-of-plane deflection of the shell. The shell is considered to consist of an arbitrary number of alternating soft and hard layers. It is assumed that the n hard membrane layers are isotropic with different elastic properties, while the (n – 1) soft core layers are orthotropic and take transverse shear only. The reduced single equation is used to calculate the axial compressive buckling loads of various buckling modes. In the case of axisymmetrical buckling, the critical load is obtained analytically in terms of the geometrical and elastic constants of the shell. For the nonsymmetrical buckling, the critical load is found by plotting the buckling load as a function of the wavelength parameter, for various wave numbers in the circumferential direction. Author

N69-19194# European Atomic Energy Community, Petten (Netherlands).
IMPROVEMENT OF NON-DESTRUCTIVE TESTING METHODS FOR VERY THICK STEEL PLATES Final Report
A. de Sterke, J. P. Domhof, W. A. M. Grandia, L. Heystek, G. F. Klinkert et al 1968 73 p refs
(Contract EURATOM-045-61-5RDN)
(EUR-3364.E) Avail: CFSTI

Nondestructive examination of welds in steel thicknesses up to 300 mm was investigated. The two methods considered were radiography, with the use of X-rays produced by megavolt apparatus and radiation of 60 Cobalt, and ultrasonic testing. Optimum radiographic exposure conditions were defined, taking into account different types of films and screens, and the qualities of radiographs obtained with the different sources of radiation were compared as to image qualities and flaw visibility. The dominant factor in decrease in flaw detection appears to be in increase of thickness when optimum exposure conditions can be met. Image quality for films under the different conditions appears to be similar. In the ultrasonic examinations, different scanning techniques were tried. It was found that the use of two probes in tandem with a probe angle of 34° reveals almost all significant weld imperfections. P.A.B.

N69-19249 National Lending Library for Science and Technology, Boston Spa (England).
TWO OBSERVATIONS ON THE PROPAGATION OF FATIGUE CRACKS
Ondrej Puchner [1968] 12 p refs Transl. into ENGLISH from Collected Sci. Works of the Mech. Engr. Fac. of the Slovak Tech. Coll. (Bratislava), no. 7, 1967
(NLL-M-7445-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

A new interpretation of the relation to crack length of the critical alternating stress at which crack propagation is arrested is discussed. An analysis is also given of the effect of geometric shape on the occurrence of arrested cracks for any given loading cycle asymmetry coefficient. Author

N69-19282*# General Electric Co., Schenectady, N. Y. Research and Development Center.
CYCLIC STRESS–STRAIN BEHAVIOR OF THE DRY POLYCARBONATE CRAZE
Roger P. Kambour and R. W. Kopp *In* Army Natick Labs. Polymer Struct. and Mech. Properties Apr. 1967 p 91–131 refs (See N69-19276 08-18)
Avail: CFSTI CSCL 20K

Equipment and methods were developed that allow photomicrographic determination of the stress–strain properties of the individual craze. Serial cyclic tensile tests on polycarbonate crazes are described. Under stress the typical dry polycarbonate craze thickens solely by straining; no adjacent polymer of normal density is converted to craze material. The craze exhibits a yield stress followed by a recoverable flow to roughly 40 to 50% strain at 6 to 8,000 psi. Returned to zero stress, the craze exhibits creep recovery at a decelerating rate. The yield stress and loss factor of each cycle decrease with increasing initial strain and cycles initiated at 50% strain or more show completely Hookean behavior. Creep recovery results in recovery of yield stress and loss factor also. Craze tensile behavior is suggested to be essentially an extension of the craze formation process. Decrease in elastic modulus and yield stress with increasing strain are rationalized in terms of a strain produced decrease in density and resultant increase in stress concentration factor on the microscopic polymer elements of the craze. Author

N69-19420# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
A NUMERICAL METHOD FOR CALCULATING THERMAL AND MECHANICAL STRESSES IN AN IRREGULAR HOLLOW CYLINDER [CALCUL NUMERIQUE DES CONTRAINTES MECANIQUES ET THERMIQUES DANS UN CYLINDRE CREUX DE SECTION DROITE IRREGULIERE]
J. Donea and S. Giuliani Oct. 1968 47 p refs In FRENCH; ENGLISH summary
(EUR-4181.F) Avail: CFSTI

A numerical method is presented for calculating thermal and mechanical stresses in an irregular hollow cylinder. The method consists of covering the section of the cylinder with a uniform network and obtaining by means of a digital computer the values of Airy's stress function at the nodes of this network. These values appear as a solution of the linear equations system resulting from the transcription of the biharmonic equation for the stress function into finite differences. Distribution of the stress function is obtained, and a numerical differentiation gives stress values. The numerical solution has been successfully compared with the analytical solution for a hollow cylinder submitted to internal pressure and to asymetrical heating. A square network was used in the presence of circular boundaries in order to show use of the method for general boundary problems. Author

N69-19508#
STRESS AND STRAIN STATE OF DISCRETELY INHOMOGENEOUS ELASTIC BODIES
V. N. Grimailo [1968] 8 p Transl. into ENGLISH from the book "Noye Metody Rascheta Stroit. Konstr." Moscow, Stroiizdat, 1968 p 149–155
Avail: CFSTI

The elastic contact in discretely-inhomogeneous bodies is studied. The case considered is one for which the material of the inhomogeneous domain is isotropic. The model is considered homogeneous when the material has identical physical and mechanical properties at all points, and inhomogeneous when the properties are functions of the coordinates. The stress diagrams for these conditions are included, and the deductions based on the investigation are listed. F.O.S.

N69-19534#
AXISYMMETRIC VIBRATIONS OF A HEMISPHERICAL SHELL PARTIALLY FILLED WITH LIQUID
V. S. Kobychkin et al [1968] 12 p refs Transl. into ENGLISH from Inzh. Zh. (Moscow), no. 5, 1968 p 46–54
Avail: CFSTI

The problem of the vibrations of a hemispherical shell partially filled with fluid is considered on the bases of the equations of couple stress shell theory. Properties of the vibrations' frequencies and modes as a function of the fluid level are investigated in examples. Membrane shell theory can be used for an approximate analysis of the natural vibrations' frequencies, however, this theory is not suitable for the analysis of the vibration modes since it results in discontinuous solutions of the equilibrium equations. Utilization of the equations of couple stress theory permit bypassing these difficulties. Author

N69-19572 National Lending Library for Science and Technology, Boston Spa (England).
PHOTOELASTICITY. AN IMPORTANT TECHNIQUE FOR MEASURING STRESS IN STRUCTURES AND STRUCTURAL COMPONENTS, PART 3 [DIE SPANNUNGSOPTIK, EIN WICHTIGES VERFAHREN ZUR MESSUNG DER BEANSPRUCHUNG IN KONSTRUKTIONEN UND BAUTEILEN, TEIL 3]
T. Gayman Sep. 1968 17 p Transl. into ENGLISH from Arch. Tech. Messen (Munich), Folio V 1371-5, Dec. 1966 p 269–274
(NLL-SMRE-Trans-5530-(8313.4)) Avail: Natl. Lending Library, Boston Spa, Engl.

The major factors to be considered in choosing a suitable model for photoelastic experiments are discussed. Requirements of the material for the three dimensional tests and special procedures to be used are included. Based on the specified properties, experiments over the past 12 years have found that epoxy resin appears to form the best model, and procedures have gradually been developed to optimize tests using this material. The basic principles of three dimensional photoelasticity, techniques of freezing stress in the model, properties considered in selecting the model material, and experimental techniques are treated in detail. A.C.R.

N69-19584 National Lending Library for Science and Technology, Boston Spa (England).
CONTRIBUTION OF SOVIET SCIENTISTS TO THE DEVELOPMENT OF THE THEORY OF CONTACT STRESS AND STRAIN
S. V. Pinegin 1968 12 p refs Transl. into ENGLISH from Mashinoved. (Moscow), no. 5, 1968 p 125–130
(NLL-M-7485-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

Reviewed are various Soviet research studies on contact stress theory. Contact stresses and relative microdisplacements in rolled compressed surfaces are characterized by exact theoretical solutions of two- and three-dimensional problems. Research on the three-dimensional shape of the contact spot produced by non-Herzian loads continuous with the inclusion of kinematically complex interactions between the participating surfaces. The development of a elastogas dynamic theory is necessary to further evaluate the problems of viscoelasticity in the two dimensional flow of lubricants in a rolling contact. G.G.

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N69-18311*# Wisconsin Univ., Madison. Dept. of Mechanical Engineering.
OSCILLATORY COMBUSTION IN ROCKETS Semiannual Report, 1 Jun.–30 Nov. 1968
J. Manrique, C. W. Savery, and R. Sowls 30 Nov. 1968 33 p refs
(Grant NGR-50-002-017)
(NASA-CR-99760; SAR-9) Avail: CFSTI CSCL 21B

Data are summarized on the investigation of vaporization in the region of the critical point. The work is divided into three projects: a theoretical investigation of droplet vaporization, an experimental investigation of vaporizing droplets suspended from a thermocouple in a flowing air stream, and an experimental investigation of vaporizing droplets falling through a hot stagnant gas. The work on the theory of a spherically symmetric drop vaporizing at steady state has been completed for a CO_2–N_2 system. The suspended droplet experiments have yielded data on Freon 13 droplets which show liquid temperatures much higher than those calculated from simple theory. The falling droplet experiments have been concerned with improving the drop forming apparatus to prevent initial disturbances of the droplet geometry. The apparatus was also modified to allow formation of CO_2 droplets. Charts summarizing experimental data are included. Author

N69-18482# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ENGINEERING-PHYSICAL JOURNAL, VOLUME 9, NUMBER 5 Selected Articles
11 Jan. 1968 25 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (Moscow), v. 9, no. 5, 1965 p 567–570, 657–666
(AD-679799; FTD-HT-23-788-67) Avail: CFSTI CSCL 20/4

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N69-18483# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NONLINEAR HEAT AND MASS TRANSFER PROBLEMS
S. M. Smirnov *In its* Eng.-Phys. J., Vol. 9, No. 5 11 Jan. 1968 p 1–6 refs (See N69-18482 08-33)
Avail: CFSTI

The article considers a system of equations of the general form: $d/dx\,[a(u)\,du/dx + a(u)\delta(u,t)\,dt/dx] = h(u)$, $d/dx\,[\lambda(t)\,dt/dx] = q(t)$. The function $\delta(u,t)$ is assumed to be a function only of t or only of u. The article treats a number of cases in which an exact analytical solution can be obtained to the above system of equations. Author

N69-18484# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL RESEARCH ON HEAT TRANSFER IN THE REGION OF THE STAGNATION POINT
V. L. Sergeyev *In its* Eng.-Phys. J., Vol. 9, No. 5 11 Jan. 1968 p 7–18 refs (See N69-18482 08-33)
Avail: CFSTI

In the case of flow around a body by a dissociated and ionized gas, the heat flux from the gas to the wall consists of the heat flux determined by the temperature gradient at the wall and the heat conductivity of the gas, as well as the heat flux determined by the gradient of the concentration of atoms, ions, and electrons. The article gives the results of heat flux measurements carried out in a jet of nitrogen, heated by an electric arc heater. The heat fluxes were measured by three methods: the method of a cooled calorimeter, the exponential method, and the Brogan method. The measurement results are exhibited graphically as a function of the enthalpy and the stagnation pressure, for diameters of the heat flux sensing device equal to 5 and 20 mm. The maximum measured value of the heat flux was 25 kilowatts/cm^2, for a value of the enthalpy corresponding to a temperature of 14,000 K. An estimate of the part of gas radiation in the value of the heat flux, without taking absorption into account. Author

N69-18502# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genèse (Belgium).
HEAT TRANSFER RATE MEASUREMENTS IN A LOW DENSITY, HYPERVELOCITY STREAM OF ARGON
G. Stickford 1968 35 p refs
(Grant AF-EOAR-67-10)
(VKI-TN-43) Avail: CFSTI

Using the transient calorimeter gage technique, heat transfer rate measurements were made on small bodies immersed in a hypersonic stream of argon in the near-free-molecule flow regime. The measurements were carried out in a free-jet expansion with stagnation conditions, produced by an electrical arc heater, of up to 3000°K stagnation temperature and 37 mm Hg stagnation pressure, giving free stream velocities of 1800 m/sec (M > 12), and particle mean free paths of 0.4 cm and greater. Measurements made with 4 models 1 cm long by 0.1 cm in width, were compared and the results indicated a reduction in the energy accomodation coefficient of 15% when the angle of incidence of the free stream decreased from normal incidence to 15° incidence. Author (ESRO)

N69-18522 Florida Univ., Gainesville.
STUDIES OF THE THERMAL EXPANSION OF OPTICAL MATERIALS AT LOW TEMPERATURES
James Steve Browder (Ph.D. Thesis) 1967 153 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-12996

A three-terminal capacitance dilatometer was designed and constructed for the purpose of investigating the thermal expansion of optical materials and other solids in the temperature range from room temperature (about 300°K) down to 16°K. Single-crystalline magnesium fluoride and three new poly-crystalline materials, Irtran 1, 2, and 4, were studied. Magnesium fluoride is an anisotropic material which has a rutile-type, tetragonal crystal structure. Its coefficients of linear thermal expansion were determined both parallel and perpendicular to the c-axis, in the temperature range 300°K to 16°K. The linear expansion coefficients of the three Irtran materials were measured in the range 300°K to about 60°K. Dissert. Abstr.

N69-18739*# Dynamic Science Corp., Monrovia, Calif.
COMBUSTION INSTABILITY RESPONSE WITH ASYMMETRIC PRESSURE DISTURBANCES
T. C. Kosvic, B. P. Breen, J. Levine, and D. E. Coats Jan. 1969 74 p refs
(Contract NAS7-467)
(NASA-CR-72494) Avail: CFSTI CSCL 21B

To more closely simulate rocket engine stability testing, provisions were made for the input of arbitrary shaped pressure and velocity waves in the Priem–Guentert Combustion Instability Model. A series of sample cases show the engine stability map to be sensitive to the shape and strength of the input disturbance with asymmetric pulses showing lower stability. An asymmetric steep fronted initial disturbance develops into a single pulse traveling wave, more closely resembling experiments. Response and gain factor calculations have been included in the program to show the time and space averaged output/input ratio of the vaporization process. Results show the average gain factor over a wave cycle to be less than one in a stable case and greater than one for an unstable case. Author

N69-18786# Rome Univ. (Italy). Scuola di Ingegneria Aerospaziale.
UNIVERSAL METHOD TO DETERMINE THE EFFECTS OF AN EXPLOSION [UN METODO GENERALE PER LA DETERMINAZIONE DEGLI EFFETTI DI UNA ESPLOSIONE]
Michele Sirinian Jul. 1968 26 p refs In ITALIAN; ENGLISH summary *Its* ATTI del Centro Ric. Aerospaziale No. 16
Avail: CFSTI

A universal method of determining the effects of an explosion is presented. This method is based on the principle of similarity which yields, for each geometrical configuration, a unique law to determine a certain effect regardless of the physical characteristics of the means which fill the surroundings and of the energy released by the explosive reaction. Only one geometrical configuration is analyzed: the surface burst. For this configuration the curves to determine the overpressure, the arrival time and the duration of the explosive wave are given. As an example these curves are used to calculate the effects of a burst of given energy release on the surface of three different planets. Author (ESRO)

N69-18808# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
NATURAL CONVECTION: THE PARTICULAR CASE OF LIQUID METALS [CONVECTION NATURELLE: CAS PARTICULIER DES METAUX LIQUIDES]
Robert Martin Sep. 1968 43 p refs In FRENCH
(CEA-BIB-128) Avail: CFSTI

A review of the main theoretical and experimental results concerning natural convection in fluids having Prandtl number equal to, or greater than one is made. The application of this mode of heat transfer to molten metals makes it possible to show the sort of difficulties encountered by research workers. Author (ESRO)

N69-18877# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
HEAT TRANSFER IN POOL BOILING LIQUID NEON, DEUTERIUM AND HYDROGEN, AND CRITICAL HEAT FLUX IN FORCED CONVECTION OF LIQUID NEON [ECHANGES THERMIQUES SUPERFICIELS DANS LE NEON, LE DEUTERIUM ET L'HYDROGENE LIQUIDES BOUILLANTS EN CONVECTION LIBRE ET FLUX DE CHALEUR CRITIQUES EN CONVECTION FORCEE DU NEON LIQUIDE]
Jean-Marie Astruc (Ph.D. Thesis--Grenoble Univ.) 1968 84 p refs In FRENCH; ENGLISH summary
(CEA-R-3484) Avail: CFSTI

Free-convection and nucleate pool boiling heat transfer (up to burn-out heat flux)between a platinum wire of 0.15 mm in diameter in neon, deuterium and hydrogen were studied at atmospheric pressure and these measurements were continued in liquid neon up to 23 bars ($P_c \cong 26.8$ b). Film boiling heat transfer coefficients were measured in pool boiling liquid neon at atmospheric pressure with three heating wires (diameters 0.2, 0.5, 2 mm) and all the results have been compared with existing correlations. Author (ESRO)

N69-18878# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
CALCULATION OF OVERTEMPERATURES PRODUCED BY A HETEROGENEOUS REACTION [SUR LE CALCUL DES SURTEMPERATURES PRODUITES PAR UNE REACTION HETEROGENE]
Jean Besson, Franz Josef Herrmann, and Karl Zankel Sep. 1968 14 p refs In FRENCH; ENGLISH summary
(CEA-R-3561-MET-9/68) Avail: CFSTI

It is shown that, when introducing some simplifying hypotheses which are generally valid, the evolution of the overtemperature by an heterogeneous reaction can be exactly calculated. The published curves make it possible to estimate its value in different cases. Author (ESRO)

N69-18896*# Florida Univ., Gainesville.
CHARACTERISTICS OF LIQUID ROCKET PROPELLANT EXPLOSION PHENOMENA
Erich A. Farber Jul. 1968 13 p refs *Its* Tech. Paper Series Vol. 22, No. 7
(Contract NAS10-1255)
(NASA-CR-100134) Avail: CFSTI CSCL 21B

It is shown how the mathematical model, developed earlier, can be used to estimate the expected explosive yields, as a result of liquid propellant rocket failures. The best available data are incorporated and a comparison is made with results obtained from liquid propellant explosion experiments. The mathematical model programmed for an IBM-360 computer is described briefly. Author

N69-18898*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CORRELATION OF GAS-SIDE HEAT TRANSFER FOR AXISYMMETRIC ROCKET ENGINE NOZZLES
Uwe H. von Glahn Washington Feb. 1969 25 p refs
(NASA-TM-X-1748) Avail: CFSTI CSCL 20M

Empirical correlating equations were developed to predict gas-side transfer for nozzles without a wall temperature step change near the nozzle entrance (such as regeneratively cooled rocket engines) over a wide range of conditions and configurations. The use of the reference enthalpy method for predicting fluid properties in these equations facilitated the correlation of heated air and rocket firing data. Author

N69-18937# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
THERMODYNAMICS OF BUBBLE CHAMBER EXPANSIONS
G. Horlitz, S. Wolff, and G. Harigel (CERN) Sep. 1968 51 p refs
(DESY-68/43) Avail: CFSTI

On the basis of an adiabatic theory a number of equations is given, which allow the study of the relations between expansion ratio, dynamic pressure, and the parasitic boiling in a bubble chamber. A dirt function η is defined as the molar fraction of the liquid which is evaporated during an expansion cycle. Furthermore a method is presented to measure η under certain assumptions from pressure--volume diagrams of bubble chamber expansions. A number of p--v diagrams taken in the 85 cm bubble chamber at DESY, has been studied; first results could be qualitatively compared with theory. The adiabatic compressibility of liquid hydrogen and deuterium has been measured at different temperatures. Author (NSA)

N69-18939# National Research Council of Canada, Ottawa (Ontario). Aeronautical Establishment.
ROCKET EXPERIMENTS ON THE HEAT TRANSFER TO A PROTUBERANCE AND TO A CAVITY
R. F. Meyer Jul. 1968 60 p refs
(NRC-10502; LR-509) Avail: CFSTI

Temperature measurements on a protuberance and a cavity mounted on a Black Brant III sounding rocket are reported. These are analyzed to give distributions of local heat transfer coefficients. Supporting wind tunnel measurements of surface pressures and surface flow visualization are also presented. Author

N69-19117*# Lockheed Missiles and Space Co., Palo Alto, Calif.
EFFECT OF ABLATION PRODUCT ABSORPTION AND LINE TRANSITIONS ON SHOCK LAYER RADIATIVE TRANSPORT
K. H. Wilson and H. Hoshizaki Washington NASA Feb. 1969 101 p refs
(Contract NAS7-509)
(NASA-CR-1264) Avail: CFSTI CSCL 20D

The effects of ablation product absorption and atomic line transitions on radiative transport within the shock layer enveloping an ablating blunt body were studied by a gas-dynamic analysis modified to handle large mass injection rates. The large mass injection rate problem was approached by two separate analyses. One approach considered a fully viscous flow but treated the velocity field solution in two separate layers. The other approach considered the total shock layer to consist of a distinct inviscid ablation product layer and distinct air layer. An approximate treatment of radiation transport in lines was devised. This approximate treatment uses the concept of "equivalent line" parameters to reduce the numerical calculations to a tractable level. Within the equivalent line approximation a mixture of C, N, and O atomic transitions is included. Two major conclusions are reached. Firstly, that energy transported in atomic lines is responsible for roughly 50% of the radiative transport within shock layers at conditions typical of superorbital entry. Secondly, ablation product species significantly absorb continuum radiative flux from the high-temperature portion of the shock layer at mass injection levels the order of 5% of the free-stream mass flux. Author

N69-19133# National Physical Lab., Teddington (England). Aerodynamics Div.

CALCULATION OF BOUNDARY LAYER DEVELOPMENT USING THE TURBULENT ENERGY EQUATION: 4: HEAT TRANSFER WITH SMALL TEMPERATURE DIFFERENCES

P. Bradshaw May 1968 35 p refs

(NPL-AERO-1271; ARC-30300) Avail: CFSTI

The exact equation for rate of change of mean-square temperature fluctuation along a mean streamline is converted into an equation for turbulent heat flux by arguments analogous to those used previously for the velocity field. Comparisons of numerical solutions with experiments on heat and foreign-gas transfer are generally within the likely experimental error. Author (ESRO)

N69-19153# Bureau of Mines, Pittsburgh, Pa. Health and Safety Research and Testing Center.

CONTINUOUS MONITORING OF DIESEL EXHAUST GAS FOR CARBON DIOXIDE, CARBON MONOXIDE, OXYGEN, METHANE, AND NITROGEN OXIDES

Helen W. Lang, W. E. O'Neil, B. A. Coulehan, and R. W. Freedman Mar. 1969 17 p refs

(BM-RI-7241) Avail: Issuing Activity

This report describes a monitoring system applied by the Bureau of Mines to provide rapid, continuous determination of the main constituents of exhaust gas during the Bureau's approval schedule testing of diesel engines for underground use. Commercially available continuous analyzers with strip chart readout are employed for nitric oxide (mass spectrometric), carbon dioxide (nondispersive infrared), methane (NDIR), carbon monoxide (NDIR), and oxygen (polarographic). Good correlation is obtained between the continuous instrumental results and those obtained by batch chemical and gas chromatographic methods. Author

N69-19183# Oak Ridge National Lab., Tenn.

THE EFFECT OF FISSION PRODUCTS ON IGNITION OF IODIZED CHARCOAL (IN PILE EXPERIMENT IGR-3)

R. P. Shields and R. E. Adams Dec. 1968 23 p refs

(Contract W-7405-ENG-26)

(ORNL-TM-2321) Avail: CFSTI

An in-pile experiment has been performed in which the ignition behavior of MSA 85851, an I_2 impregnated (iodized) charcoal, was studied in the presence of fission products. After 4 hours of exposure to volatile fission products, this charcoal ignited at a temperature 35°C lower than it did in the laboratory: 327 vs 362°C. A second charcoal adsorber containing a 2-inch depth of MSA 85851 charcoal was exposed to determine the distribution of radioiodine in a charcoal mass: 73% was in the first 0.5 inch, 13% in the next 0.8 inch and 4% in the remaining 0.7 inch. Approximately 10% of the I_2 entering this adsorber passed through and was found in a second charcoal adsorber. Author (NSA)

N69-19297*# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

HEAT TRANSFER TO A GAS CONTAINING A CLOUD OF PARTICLES Final Report, 1 Jun. 1962–31 May 1968

Edward Y. H. Keng and Clyde Orr, Jr. Jan. 1969 141 p refs

(Grant NGR-11-002-003)

(NASA-CR-73880) Avail: CFSTI CSCL 20M

Fundamental information on radiant heat transfer to particle clouds was developed. The analysis performed was to be used in the evaluation of various nuclear rocket engine designs and in industrial high temperature applications. This investigation involved a wide variety of problems, including particle cloud generation, optical properties of particle clouds, and particle gasification in addition to radiant heat transfer to particle clouds. Four types of particle cloud generators were designed and tested. Their merits and shortcomings are discussed. Extinction coefficients and the transmissivity of particle clouds were measured. Discussions are included on the dependence of the wavelength of the radiation and the concentration of the particle cloud. Experimental measurements of particle gasification were not obtained due to the lack of a sufficiently intense radiant source. Author

N69-19300# Institut Franco-Allemand de Recherches, St. Louis (France).

RESTITUTION TECHNIQUE OF PROFILE AND DEFINITION OF PROFILE MEANS OF METAL PROJECTILE RECOVERY AFTER AEROTHERMODYNAMIC ABLATION [TECHNIQUE DE RESTITUTION DES PROFILS ET DEFINITION DU PROFIL MOYEN DE PROJECTILES METALLIQUES RECUPERES APRES ABLATION AEROTHERMODYNAMIQUE]

J. Luneau 1 Sep. 1967 30 p refs In FRENCH

(ISL-N-16/67) Avail: CFSTI

A technique for determining a mean profile of revolution, resulting from aerodynamic ablation occurring in the air and uncontaminated by shock deformation or supplementary ablation, is given for recovered projectiles. Technical apparatus used in the determination of the profiles is described. The profiles are then applied to studies of wind tunnel models of metal projectiles. Transl. by P.A.B.

N69-19330*# Scripta Technica, Inc., Washington, D. C.

KINETIC PROPERTIES OF AIR AND OTHER GASES AT HIGH TEMPERATURES [KINETICHESKIYE SVOYSTVA VOZDUKHA I DRUGIKH GAZOV PRI VYSOKIKH TEMPERATURAKH]

Yu. N. Belyayev et al NASA Aug. 1968 14 p refs Transl. into ENGLISH from Fiz. Goreniya Vzryva (Novosibirsk), v. 3, Jun. 1967 p 171–187

(Contract NASw-1694)

(NASA-TT-F-11837) Avail: CFSTI CSCL 20M

A discussion of semiempirical and experimental methods for determining the interaction potentials of various gas molecules is presented. Transfer cross sections are investigated in homogeneous individual gases and in gas mixtures at high temperatures and in the absence of ionization. The disadvantages of a semiempirical method, as applied and improved by Mason and Vanderslice, are pointed out. The benefits of an experimental method, based on measurement of fast-beam elastic energy scattering, in studying intermolecular forces are noted. This method gives high-temperature transfer cross sections for interacting gas systems involving chemical radicals and intermediate reaction products. The experimental setup is described. Author

N69-19347# Maryland Univ., College Park. The Inst. for Fluid Dynamics and Applied Mathematics.

NUMERICAL STUDIES OF PENETRATIVE CONVECTIVE INSTABILITIES

Allen J. Faller and Robert Kaylor Jun. 1968 26 p refs

(Grant NSF GP-3443)

(BN-554) Avail: Issuing Activity

The stability problem of thermal convection for a statically unstable layer surmounted by a statically stable layer has been attacked by direct numerical integration of the equations of motion and heat conduction. Two types of vertical temperature variations are considered, namely a piecewise linear distribution and a piecewise parabolic distribution. In both cases the ratio of the vertical gradient of temperature in the upper layer to the corresponding gradient in the lower layer is given by a specified parameter χ. Numerical values of a critical Rayleigh number, the most unstable wave lengths, and the depths of penetration of the convective cells into the stable region are given for several values of χ. The calculated forced cells that occur in the stable region are in good agreement

with an appropriate linear theory. Comparison of the results for χ_p (parabolic) = −1 with the case of counter rotating cylinders (Harris and Reid, 1964) shows a significant difference in the penetrati of the cells despite equality of the parameters at instability. Author

N69-19396#
DEGREE OF BLACKNESS OF A TUBULAR RADIATOR IN THE PRESENCE OF NONISOTHERMY
B. A. Khrustalev 1968 12 p refs Transl. into ENGLISH from Nauka Press (Moscow), 1968 p 219–230
Avail: CFSTI

An accurate computation of nonuniformly heated radiators is known to be difficult since a rigorous description of the problem results in nonlinear integro-differential equations, for which only a numerical solution is possible. A simplified computation is made by a purely analytic differential method and an integral method involving light simulation. A comparison of the results of computing the cavity blackness (A) for a nonuniformly heated, sufficiently long cylinder by the two methods showed that the differential method yielded an estimate of A which is rather reduced as compared with the integral method. The integral method of computation, utilizing the governing angular coefficients determined in the light model, allowed a more exact computation of the radiant heat exchange in a tubular cavity than did the differential method. B.P.

N69-19460#
METHOD OF COMPUTING THE NONSTATIONARY HEAT CONDUCTIVITY IN BODIES OF SIMPLE SHAPE, COOLED OR HEATED BY THERMAL RADIATION
E. S. Turilina et al [1968] 7 p refs Transl. into ENGLISH from the book "Teploobmen, Gidrodin. i Teplofizich. Svoistva Veshchestva" Moscow, Izd. AN SSSR, 1968 p 230–236
Avail: CFSTI

An approximate analytical method for bodies of simple shape (infinite plate, long cylinder, sphere) is presented, with cooling or heating by thermal radiation. The method is based on solving the appropriate nonlinear problem using successive approximations, executed in analytic form. The sufficiency of the second approximation is proved by comparing it with results of a numerical solution of the same nonlinear problem performed by computer. Author

N69-19472# Grumman Aircraft Engineering Corp., Bethpage, N. Y.
THE DESIGN AND TEST OF TWO SPACE RADIATOR CONFIGURATIONS. VOLUME 1: STRUCTURAL DESIGN AND TEST
I. Birnbaum, T. Foley, F. Halfen, and J. Kennedy Dec. 1968 93 p refs
(FSR-AD4-02-68.3-Vol-1) Avail: Issuing Activity

The design, fabrication, and testing of two configurations of space radiator panels are discussed. The two configurations evolved from and are designed to meet the requirements of a two month, manned earth orbital mission. One radiator design incorporates adhesive bonding while the other is an all-welded arrangement. The feasibility of each design has been demonstrated by structural and thermal tests. The structural design, fabrication, structural test results and generalized discussion, aimed at structures specialists, of thermodynamic radiator requirements and characteristics are presented. Author

N69-19480# Sandia Corp., Albuquerque, N. Mex. Aerospace Nuclear Safety Dept.
THERMAL AND ABLATION RESPONSE OF SMALL SPHERICAL PARTICLES IN REENTRY Summary Report
B. W. Marshall Oct. 1968 140 p refs Supported in part by AEC
(SC-RR-68-547) Avail: CFSTI

The reentry response of small spherical particles includes the thermal response of the particle and the melting of and mass loss (ablation) from the body. Results are presented of theoretical calculations to determine the conditions of melt for release in reentry, analytical studies to determine liquid layer and liquid droplet stability conditions in reentry, and experiments on small particle ablation conducted in a hyperthermal arc tunnel, a hypersonic shock tunnel, and a free-flight gun range. Author (NSA)

N69-19500 National Lending Library for Science and Technology, Boston Spa (England).
DETONATION OF LIQUID EXPLOSIVE MIXTURES AT LOWERED TEMPERATURES [DETONATSIYA ZHIDKIKH VZRYVCHATYKH SMESEI PRI PONIZHENNYKH TEMPERATURAKH]
V. A. Letyagin et al [1968] 8 p refs Transl. into ENGLISH from Fiz. Goreniya i Vzryva (Moscow), no. 3, 1967 p 393–397
(NLL-M-7480-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

Results of experiments to determine the detonating power of liquid explosive mixtures undergoing rapid cooling are presented, where a charge with finely dispersed structure is formed, having a particle size of 5 to 10μ. Several phenomena which accompany rapid cooling of liquid explosives are described, and it is noted that explosives with identical chemical compositions may differ in detonating power as a result of different physical states. Thus, by altering the physical properties of a mixture, varying speeds of stable detonation may be obtained. The initiation and development of detonation were recorded using a high speed photorecorder with slit scanning. Various assemblies and techniques were used to study the detonation of mixtures of tetranitromethane–benzene (70:30) and tetranitromethane–petrol (70:30), and the results are summarized in a table. These results could be presented in the same table because both explosives showed the same detonation speed under normal conditions, and the conditions of crystallization of the binary solutions of fuel and oxidizing agent were similar. The table indicates a clear relationship between detonation speed and temperature. A.C.R.

N69-19545 National Lending Library for Science and Technology, Boston Spa (England).
INFLUENCE OF COMBUSTION ON TURBULENCE AND MIXING IN TURBULENT DIFFUSION FLAMES [EINFLUSS DER VERBRENNUNG AUF TURBULENZ UND MISCHUNG IN TURBULENTEN DIFFUSIONSFLAMMEN]
H. Eickhoff Nov. 1968 11 p refs Transl. into ENGLISH from Chem.-Ing.-Tech. (Bergstr.), v. 40, no. 20, Oct. 1968 p 995–998
(NLL-SMRE-Trans-5676-(8313.4)) Avail: Natl. Lending Library, Boston Spa, Engl.

Tests were made in perpendicularly burning, axially-symmetrical free jet flames in order to find out how the mixing of the fuel (town's gas) with the air and the degree of turbulence change in different ignition conditions. The degree of turbulence was assumed to be the ratio of the fluctuating radial speed to the mean speed in the main flow direction and was calculated from the measurements of static and total pressure. The pressure probes were calibrated in turbulent air jets, by comparison with hot-wire measurements. The tests demonstrated that the turbulent mixing and the degree of turbulence are considerably reduced as a result of combustion. Author

N69-19556# Institut Franco-Allemand de Recherches, St. Louis (France).
STUDY OF THE IONIZATION ALONG A STREAM LINE [ETUDE DE L'IONISATION LE LONG D'UNE LIGNE DE GOURANT]

G. Lacau 21 Dec. 1967 15 p refs In FRENCH
(ISL-N-30/67) Avail: CFSTI

A study was made to investigate under what conditions the hypothesis of thermodynamic equilibrium is valid in determining flow fields. Efforts were focused on calculating electronic density and the speed of electron production along the current lines of a flow in chemical equilibrium. Equations of chemical kinetics were utilized to indicate whether or not the hypothesis of equilibrium is justified concerning ionization and were applied to calculation of the speed of appearance of a species particle in the air. Numerical examples are given and discussion held as to the exactness of calculations. Although the ionization reaction may not be in equilibrium, it brings in only a small amount of energy; it is therefore probable that, if the other reactions are in equilibrium, the calculation made for the lines of current under the hypothesis is almost exact. Transl. by P.A.B.

N69-19567#
METHODS OF DETERMINING THE INTEGRAL AND SPECTRAL RADIATIVE PROPERTIES OF MATERIALS AT HIGH TEMPERATURES
A. M. Rakov et al [1968] 21 p refs Transl. into ENGLISH from THE BOOK "Teploobmen, Gidrodinamika i Teplofizicheskie Svoistva Veshchestva" Moscow, Izd. AN SSSR, 1968 p 174–190
Avail: CFSTI

In order to obtain a complex of spectral and integral radiative properties of heat-resistant materials at high temperatures, an apparatus was constructed and an experimental method was developed to make a complex of measurements on one sample of material. The method permitted determination of integral hemispherical and normal degrees of blackness; spectral normal radiative characteristics in the infrared spectrum range (1 to 5.5 μm) and in the visible range for $\lambda = 0.65$ μm, as well as $\lambda = 0.365$, 0.460, 0.550, 0.655 μm; and the radiation intensity distribution at various angles to the surface. Author

N69-19568
AN ULTRASONIC TECHNIQUE FOR DETERMINING THE THERMODYNAMIC PROPERTIES OF ARGON AT LOW TEMPERATURES [EKSPERIMENTALNOE ISSLEDOVANIE TERMODINAMICHESKIKH CVOISTV ARGONA PRI NIZKIKH TEMPERATURAKH UL TRAAKUSTICHESKIM METODOM]
I. S. Radovskii Jan. 1969 17 p refs Transl. into ENGLISH from Teplo-i-Massoperenos (USSR), no. 7, 1966 p 152–163
(NLL-RTS-4923) Avail: Natl. Lending Library, Boston Spa, Engl.: 30s

Tests were conducted to obtain systematic experimental data on the velocity of sound in gaseous and liquid argon over the temperature range 64° to 173°K at a pressure of 61 bar, and also over the critical range and in the gas and liquid phases over the entire phase equilibrium curve. Another problem investigated was the development of a simpler and sufficiently accurate technique for simultaneously measuring the density and velocity of sound using one piece of equipment, and of determining the density of gaseous argon over approximately the same ranges of temperature and pressure. An acoustic interferometer, with a variable distance between the ultrasonic transducer and the reflector, was used for the measurements. The technique is based on the occurrence of standing waves in the medium between the sound radiator and the reflector. Author

N69-19570# National Lending Library for Science and Technology, Boston Spa (England).
CONDENSATION OF STEAM IN PLATE HEAT EXCHANGERS [ISSLEDOVANIE PROTESSA KONDENSATSII VODYANOGO PARA V KANALAKH PLASTINCHATOGO TEPLOOBMENNIKA]
L. L. Tovazhnyanskii et al Dec. 1968 6 p Transl. into ENGLISH from Khim. Mashinostr. (Moscow), v. 3, 1966 p 73–78
(NLL-RTS-4915) Avail: Natl. Lending Library, Boston Spa, Engl.: 15s

Results obtained in condensation of dry saturated steam in channels of a horizontally corrugated plate heat exchanger are reported. It is concluded that plate heat exchangers are highly effective for condensing vapors under high pressure, and as dephlegmators when surface fouling occurs. Charts summarizing the experimental data are included. F.O.S.

N69-19578 National Lending Library for Science and Technology, Boston Spa (England).
SOME PROBLEMS OF GENERALISATION OF EXPERIMENTAL DATA IN HEAT AND MASS TRANSFER [O NEKOTORYKH VOPROSAKH OBOBSHCHENIYA EKSPERIMENTAL'NYKH DANNYKH PO TEPLO- I MASSOOBMENU]
M. V. Lykov et al Dec. 1968 6 p refs Transl. into ENGLISH from Khim. Prom. (Leningrad), v. 42, no. 2, 1966 p 120–123
(NLL-RTS-4231) Avail: Natl. Lending Library, Boston Spa, Engl.: 10s

The validity is questioned of previously published data which claim that many of the empirical equations do not describe the kinetics of heat and mass transfer and cannot be recommended for the design of industrial equipment. Particular exception is taken to the following assertions: (1) The equations have either no physical meaning at all or are thinly veiled heat and mass balances. (2) Empirical formulas obtained from dimensional analysis of a single phase are used indiscriminately in describing the kinetics of mass transfer in a two-phase system. (3) The general formulas obtained in no way describe the kinetics of the operations as they are based on incorrect application of dimensionless groups of a single-phase to a two-phase system. M.G.J.

N69-19599 National Lending Library for Science and Technology, Boston Spa (England).
ROLE OF THE LEADING SHOCK WAVE IN THE SPREAD OF SLOW-SPEED DETONATION IN LIQUID NITROGLYCERIN CHARGES [ROL' OPEREZHAYUSHCHEI UDARNOI VOLNY V RASPROSTRANENII MALOI SKOROSTI DETONATSII V ZARYADAKH ZHIDKOGO NITROGLITSERINA]
A. V. Dubovik et al [1968] 8 p refs Transl. into ENGLISH from Fiz. Goreniya i Vzryva (Moscow), no. 4, 1966 p 105–110 In ENGLISH and RUSSIAN
(NLL-M-7479-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

In studying the nature of slow speed detonation regimes in charges of liquid explosives, it was found that the most complex problem is that of initiation of a sufficiently rapid explosive reaction by the weak shock wave. A series of experiments was therefore conducted to ascertain the character of the wave perturbations spreading along the envelope ahead of the slow speed detonation front in nitroglycerin. Various methods are described for determining such factors as the presence of the series of compression waves ahead of the detonation front; the intensity of the shock wave entering the nitroglycerin from the walls of the envelope; the pressure at the front; combustion velocity; and the disturbance of continuity phenomena in the rarefaction wave following the shock wave. Evaluation of the various methods and equipment used is also included. A.C.R.

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N69-18491# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

NEWS OF INSTITUTIONS OF HIGHER LEARNING. PHYSICS, VOLUME 10, NUMBER 6 Selected Articles

15 May 1968 13 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (Tomsk), v. 10, no. 6, 1967 p 145–147, 158–160

(AD-679810; FTD-HT-23-255-68) Avail: CFSTI CSCL 20/9

CONTENTS:

1. ELECTRICAL EXPLODING OF FOIL Yu. P. Kostochko et al p 1–4 refs (See N69-18492 08-25)

2. EXPERIMENTAL INVESTIGATION OF THE ATMOSPHERIC ABSORPTION OF GAS LASER RADIATION WITH A WAVELENGTH OF 1.15 μm B. A. Antipov et al p 5–8 refs (See N69-18493 08-16)

N69-19001*# Oklahoma State Univ., Stillwater. College of Engineering.

A PILOT PROGRAM FOR SELECTING, EDITING AND DISSEMINATION ENGINEERING AND SCIENTIFIC EDUCATIONAL SUBJECT MATTER FROM NASA TECHNICAL REPORTS Annual Report, 1 Sep. 1967–30 Nov. 1968

30 Sep. 1968 96 p refs

(Contract NSR-37-002-045)

(NASA-CR-100187; ER-69-I-2) Avail: CFSTI CSCL 05I

Educational monographs were distributed to 255 professors in 108 universities and received 11 favorable responses for each unfavorable response. Visual briefs were distributed to 73 professors in 46 universities and were received with similar success. Although this is an annual report, progress of the entire program is presented in many places to illustrate total achievement. The nature of the program requires this type of presentation. Details of quarterly or yearly progress are shown when it enhances the presentation. In the statement of work for the second contract period a number of objectives particularly significant to the program have been listed. Author

N69-19053*# New Mexico Univ., Albuquerque. Technology Application Center.

[REGIONAL DISSEMINATION CENTER OPERATION AT THE TECHNOLOGY USE STUDIES CENTER] Quarterly Status Report, Jul.–Dec. 1968

William A. Shinnick Feb. 1969 24 p

(Contract NSR-32-004-049)

(NASA-CR-100158) Avail: CFSTI CSCL 05B

A status report is presented on progress during the first two quarters of the 1968 fiscal year. The effects of administrative reorganization on the center's programs, results of marketing operations, and sponsorship of a national conference on Rolamite device technology are discussed. Technical services were expanded by utilizing data bases other than that of NASA to provide clients with more comprehensive coverage, and by the establishment of a selective dissemination service based on NASA's SCAN program. Advertising increases resulted in doubling of orders for Gemini photography during the second quarter. A.C.R.

N69-19128*# National Aeronautics and Space Administration, Washington, D. C.

NINETEENTH SEMIANNUAL REPORT TO CONGRESS, 1 JANUARY–30 JUNE 1968

30 Jun. 1968 251 p refs

(NASA-TM-X-61453) Avail: SOD $1.25/CFSTI CSCL 22

NASA's manned space flight achievements during this period included the first unmanned flight of the Apollo lunar module and the second unmanned Apollo–Saturn 5 mission. Efforts continued to improve Apollo spacecraft delivery schedule. Mission planning and hardware development continued for the Apollo Applications Program, and studies of advanced manned missions for the post-Apollo period were conducted. An Orbiting Geophysical Observatory, Explorer 37, and IRIS, a European Space Research Organization satellite were launched. In addition, Surveyor 7 landed on the moon. The tracking and data acquisition networks provided support to 69 missions, 10 of which were launched during the period. S.P.G.

N69-19196# Universidad Mayor de San Andres, La Paz (Bolivia). Laboratorio de Fisica Cosmica.

THE ROLE OF THE COSMIC PHYSICS LABORATORY IN THE DEVELOPMENT OF THE BOLIVIAN SCIENCE AND TECHNOLOGY [EL ROL DEL LABORATORIO DE FISICA COSMICA EN EL DESARROLLO DE LA CIENCIA Y TECNOLOGIA BOLIVIANA]

G. R. Mejia Oct. 1968 27 p refs In SPANISH

Avail: CFSTI

An overview is presented on the role which the University of San Andreas plays in the development of culture and education in Bolivia, as well as its contribution to science and technology. The university started in 1946, when in cooperation with English and Brazilian scientists a limited study on Chacaltays was undertaken. Based on the discovery of a new particle, the heavy meson, several American universities, particularly Massachusetts Institute of Technology, gave financial and technological support to the laboratory. The establishment of post graduate courses is discussed in terms of training new personnel for the advanced scientific fields. Transl. by F.O.S.

N69-19197*# Southwest Research Inst., San Antonio, Tex.

SOUTHWEST RESEARCH INSTITUTE ASSISTANCE TO NASA IN BIOMEDICAL AREAS OF THE TECHNOLOGY UTILIZATION PROGRAM Final Report, 1 Nov. 1967–30 Nov. 1968

Ray W. Ware, Felix L. St. Clair, III, Brian Caruth, Charles J. Laenger, Sr., Robert J. Crosby et al 31 Dec. 1968 130 p refs

(Contract NASw-1714; SwRI Proj. 14-2329)

(NASA-CR-100018) Avail: CFSTI CSCL 05B

The general program is described, and activities for this reporting period are listed. An operations research analysis and evaluation of the technology transfer process is briefly discussed. The actual transfers for the period are analyzed in detail, including a potential transfer. The processing status of all biomedical problems at the time of the report and new problems are identified. Separate case histories for each problem are given. The documents furnished to the participants of the program are also listed. K.W.

N69-19242# IIT Research Inst., Chicago, Ill.

TECHNOLOGY IN RETROSPECT AND CRITICAL EVENTS IN SCIENCE, VOLUME 1

15 Dec. 1968 119 p

(Contract NSF C-535)

Avail: Issuing Activity

The historical tracing of key scientific events which led towards five major technological innovations are presented. The subjects of these tracings are: (1) magnetic ferrites, (2) video tape recorder, (3) oral contraceptive pill, (4) electron microscope, (5)

matrix isolation. The data collected were carefully analyzed. This study produced findings which not only substantiated some intuitively accepted beliefs but which also yielded some interesting points that shed new light on the very involved process which leads from research to innovation. In all cases studied, nonmission research provided the origins from which science and technology could advance toward the innovations which lay ahead. Author

N69-19245# Maryland Univ., College Park. Center of Materials Research.
MATERIALS SCIENCES PROGRAM. Annual Technical Report, 1 Jul. 1967–30 Jun. 1968
Jun. 1968 44 p refs
(Contract ARPA SD-101)
(AD-678949) Avail: CFSTI CSCL 11/7

This report summarizes the extensive program of research in Materials Sciences at the University of Maryland during the period 1 July 1967 through 30 June 1968. Faculty from the Departments of Chemistry, Physics, Molecular Physics, Chemical Engineering and Mechanical Engineering share this effort. The individual projects have been grouped into seven general areas of research. The faculty member responsible for each project is designated, and the sources of funds for a particular project are indicated. Lists of participating faculty, research associates, and graduate students are provided in subsequent sections. A complete listing is also given of the publications which have resulted from the research program. Author (TAB)

N69-19251*# California Univ., Berkeley. Space Sciences Lab.
A CRITICAL REVIEW OF SYSTEMS ANALYSIS: THE CALIFORNIA EXPERIENCE
Ida R. Hoos Dec. 1968 51 p refs *Its* Internal Working Paper No. 89
(Grant NGL-05-003-012)
(NASA-CR-100029) CSCL 05K

The socio-economic aspects of utilizing the technologies developed for and in the aerospace industry are recounted. The feasibility of using space engineering to solve difficult social problems was studied by four California based aerospace industries. Their findings are reported on the analyses of waste management, criminal justice, information, transportation, and public welfare. A critique of their conclusions is presented. It was stated that systems analysis as a tool in social planning cannot be assessed in isolation from (1) the particular technicians using it, (2) the salesmanship permeating it, and (3) the political environment surrounding it. Foremost among the contribution of the California experience was the rediscovery of the basically multifaceted nature of every major problem facing the government planner. This indicated a clearcut need for knowledge on many fronts and involving many kinds of capabilities; economic, political, and social rationality all must contribute to developing viable models for understanding the complex problems of society. B.P.

N69-19305# National Science Foundation, Washington, D. C.
NATIONAL SCIENCE FOUNDATION. EIGHTEENTH ANNUAL REPORT FOR THE FISCAL YEAR ENDING, 30 JUNE 1968
30 Dec. 1968 292 p refs
(NSF-69-1) Avail: SOD $1.25

An account of major activities in support of scientific research and education in the sciences is presented. The activity summaries are arranged by major field of science and cover mathematical and physical sciences, biological and medical sciences, environmental sciences, engineering, social sciences, and graduate and undergraduate education in science. Other summaries are given of institutional programs, computing activities in education and research, sea grant programs, science information processing, international science activities, and science planning and policy studies. Organizational and administrative information is included. K.W.

N69-19358# Joint Publications Research Service, Washington, D. C.
CYBERNETICS AND REGULATION THEORY, USSR
13 Feb. 1969 16 p refs
(JPRS-47451) Avail: CFSTI

CONTENTS:

1. APPROXIMATION OF THE DYNAMIC CHARACTERISTICS IN A CLASS OF GENERALIZED FUNCTIONS V. K. Zadiraka et al p 1–7 refs (See N69-19359 08-19)
2. AUTOMATION TO INCREASE THE PRODUCTIVITY OF LABOR A. Letov p 8–12 (See N69-19360 08-05)

N69-19408*# Washington Univ., St. Louis, Mo. Dept. of Economics.
PLANNING PROGRAMMING BUDGETING SYSTEMS. SELECTED CASE MATERIALS
Murray L. Weidenbaum Feb. 1969 44 p refs *Its* Working Paper No. 6900
(Grant NGR-26-008-003)
(NASA-CR-100030) Avail: CFSTI CSCL 05C

Planning, programming, and budgeting profiles for an organization are developed by: (1) identification of the overriding objectives; (2) development of an array of feasible alternatives for achieving these objectives; (3) systematic choice between the alternatives; and (4) conversion of results into operational decisions. G.G.

N69-19411*# Oklahoma State Univ., Stillwater. College of Engineering.
A PILOT PROGRAM FOR SELECTING, EDITING AND DISSEMINATING ENGINEERING AND SCIENTIFIC EDUCATIONAL SUBJECT MATTER FROM NASA TECHNICAL REPORTS. APPENDIX 12. Annual Report, Sep. 1, 1967–Nov. 30, 1968
30 Nov. 1968 140 p
(Contract NSR-37-002-045)
(NASA-CR-100145; ER-69-I-2) Avail: CFSTI

Dissemination and evaluation statistics and analyses for various educational monographs on engineering and scientific technology systems are presented in subsections. Topics range from theoretical and computer calculations on thermodynamics to mathematical models for generating automatic control systems. A brief abstract is given for each monograph together with pertinent evaluation ratings and educator comments. G.G.

N69-19427*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY NO. 37–54, VOLUME 3 FOR THE PERIOD OCTOBER 1 TO NOVEMBER 30, 1968. SUPPORTING RESEARCH AND ADVANCED DEVELOPMENT
31 Dec. 1968 250 p refs
(Contract NAS7-100)
(NASA-CR-98695; JPL-SPS-37-54-VOL-3) Avail: CFSTI CSCL 22

CONTENTS:

1. SYSTEMS DIVISION p 1–36 refs (See N69-19428 08-30)
2. PROJECT ENGINEERING DIVISION p 37–39 refs (See N69-19429 08-04)
3. GUIDANCE AND CONTROL DIVISION p 40–82 refs (See N69-19430 08-31)
4. ENGINEERING MECHANICS DIVISION p 83–90 refs (See N69-19431 08-09)

5. PROPULSION DIVISION p 91–132 refs (See N69-19432 08-27)
6. SPACE SCIENCES DIVISON p 133–170 refs (See N69-19433 08-11)
7. TELECOMMUNICATIONS DIVISION p 171–229 refs (See N69-19434 08-07)
8. ADVANCED STUDIES p 230–238 (See N69-19435 08-30)
9. FACILITIES OFFICE p 239–243 ref (See N69-19436 08-11)

N69-19437# Hughes Aircraft Co., Culver City, Calif. Technical Library Services.
TECHNICAL PROPOSAL WRITING: A BIBLIOGRAPHY
John T. Milek, Jan Seremak, Rose E. Konrath, and Masse Bloomfield Jan. 1969 15 p refs
(LS-BIB-69-1) Avail: Issuing Activity

This bibliography, consisting of over 240 citations, was prepared in response to the needs of many engineers involved in the writing of proposels. Selected citations cover open literature as well as report literature. Author

N69-19501# Joint Publications Research Service, Washington, D. C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE NO. 197
30 Jan. 1969 72 p refs Transl. into ENGLISH from various Russian publ.
(JPRS-47342) Avail: CFSTI

CONTENTS:
1. ASTRONOMY p 1–6 refs (See N69-19502 08-30)
2. METEOROLOGY p 7–20 refs (See N69-19503 08-20)
3. OCEANOGRAPHY p 21–31 refs (See N69-19504 08-13)
4. TERRESTRIAL GEOPHYSICS p 32–44 refs (See N69-19505 08-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 45–68 refs (See N69-19506 08-30)

N69-19528# Joint Publications Research Service, Washington, D. C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE NO. 198
13 Feb. 1969 64 p refs Transl. into ENGLISH from various Russian publ.
(JPRS-47449) Avail: CFSTI

CONTENTS:
1. ASTRONOMY p 1–7 refs (See N69-19527 08-30)
2. METEOROLOGY p 8–22 refs (See N69-19528 08-20)
3. OCEANOGRAPHY p 23–33 refs (See N69-19529 08-13)
4. TERRESTRIAL GEOPHYSICS p 34–43 refs (See N69-19530 08-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 44–55 refs (See N69-19531 08-30)

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